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# PSYCHOLOGY
# *of*
# INDIVIDUAL DIFFERENCES

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# PSYCHOLOGY
# *of*
# INDIVIDUAL DIFFERENCES

BY

A. R. GILLILAND, PH.D.

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NORTHWESTERN UNIVERSITY

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# Preface

THE purpose of this book is to collect in one volume the more important facts and conclusions in the broad field of the psychology of individual differences. Complete changes in the interpretation of the work of others which are sometimes attempted are rarely valid, and are not attempted in this book. The arrangement of materials, while not without some overlapping, follows rather closely the traditional outline of the ways and the extent to which people differ. The student will find the usual division of differences into those which are associated with sex, race, and age, as well as a consideration of differences on the basis of heredity and environment.

The quantitative nature of this subject has been emphasized throughout by the inclusion of numerous graphs and tables of original data. Since the understanding of statistical data is of prime importance, considerable space—although not as much as some would desire—has been devoted to a treatment of statistical concepts. Because of the increasing necessity for an understanding of statistical methods, students who would follow even casually the original investigations of psychology must go far beyond the material of our chapter on quantitative methods. The omissions of this chapter are offset in part by the exercises at the end of each chapter. The questions in these exercises may prove to be of considerable help to the instructor, but they are designed primarily to suggest interpretations of presented data as well as to call the attention of the student to the more important conclusions of the chapter. Since the material of the psychology of individual differences has broad applications in the fields of education and business, we have devoted a rather long chapter to each of these fields.

This publication, like all others attempting to summarize a field of extensive quantitative studies, is necessarily composed chiefly of the work of other students of psychology, to whom due acknowledgment has been made in the footnotes whenever possible. However, since much of the information presented here has long been familiar to psychologists, it was not always practicable to credit these sources directly. We are grateful to the writers and publishers who have kindly granted permission for the use of excerpts and illustrations from their publications, and we have tried in every instance to make appropriate acknowledgment of their generosity. We are also indebted to numerous persons whose help, though indispensable, they have considered as little more than a part of the routine of their daily lives.

A. R. G.
E. L. C.

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## CHAPTER I

# The Problem of Individual Differences

### Statement of the Problem

The fact that no two things are exactly alike is so universally recognized as to be a truism. Complex structures have more possibilities for being different than have simple ones. Living organisms, to the extent to which they are more complex than inanimate objects, exhibit more differences one from another.

If we compare any two individuals of the same species, we find differences between them. This is true of all animals, from the simplest to the most complex. Biologists have found that even the one-celled amoebae, although very similar in form and structure, still differ one from another. More complex animals, of course, show greater differentiation. In human affairs the fact of individual differences has been recognized since man's earliest experiments in social organization.

Animals behave as if they were in some vague way aware of differences among themselves. Bees have their queen, drones, and workers, with workers subdivided for special tasks. For each herd of sheep, cattle, or horses, as for each pack of wolves, there is a leader. Flocks of wild fowl, such as ducks and geese, fly in the familiar

V-formation, with one leading the group from the most forward position in the center. From this leader the rest of the flock take their direction in flight.[1]

In prehistoric and primitive races of men, the father was the ruler of the family. In the tribes there were many fathers. The patriarch or eldest man of the tribe held a position of leadership over the larger family group. When tribes were joined together into larger groups and into nations, the problem of selecting a leader became more complicated. There was the problem of one central authority with many lesser leaders. Furthermore, leadership was complicated by the division of responsibility. There was a king or chief as political leader, a priest as religious leader, and sometimes a prophet or a soothsayer for guidance in health and the practical problems of life. With the greater specialization of duties and functions, the division of leadership became more and more of a problem.

But these were practical aspects of the generally recognized fact of individual differences. In order to make greater progress, it was necessary that the problems of differences be studied and analyzed. Plato, writing nearly four hundred years B.C., was apparently the first person to appreciate the theoretical problems regarding differences between people. In his *Republic,* he not only recognized differences but set up a plan for an ideal state which took them into consideration. In this ideal state men were divided into three classes according to their ability. These three classes were the artisans, the soldiers, and the rulers. The first class was to receive no special training, but for the latter classes Plato recommended an elaborate training under the control of the state. Up to the age of twenty the two groups were to be trained together. Upon reaching this age, those capable of further training were selected for ten years of additional education. From this group the most select were chosen to receive yet another five years' training in dialectic. As the finest and most intelligent men of the nation, they were to be rulers over the people.

---

[1] Just how the leader of such groups of animals is selected is not clear. It is probable that physical prowess is a large factor in the selection of leaders in most animal groups. Generally the leader is a male and, as a rule, is the largest and strongest of the group.

Aristotle, a pupil of Plato, disagreed with his teacher in several important points regarding the nature of the ideal state and the education of its youth. He agreed with Plato that education should be a function of the state. Though both excluded slaves and artisans from the benefits of formal education, Aristotle would deny citizenship to artisans and laborers. Education and citizenship was reserved only for those competent and free to benefit from such training. Instead of dividing citizenship into three classes with separate training for each class, as Plato suggested, Aristotle believed that all citizens should receive the same kind of training. This he divided into three periods. The first extended to the end of the seventh year and should consist only in play and free exercise. The second period extended to the age of twenty-one, during which attention should be directed to the study of "letters, gymnastics, music and drawing." The purpose of such instruction should be partly for practical training but primarily for appreciation and pleasure. Aristotle decried training in music, for example, for the purpose of public performance before audiences. Such performance, in his estimation, lowered the performer to the level of craftsman. After twenty-one those who had completed the state system of education were to be given posts in the army or executive positions in government. Such persons should study ethics and politics, not only to become better soldiers and statesmen but to prepare them for later life. After service in the army and state, citizens should gradually assume posts demanding less active participation and more reflection. This should be a period of devotion to religious contemplation, happiness, and living the good life. Woman, in Aristotle's plan, was to be educated not by the state but in the home by father and husband. Such education should befit the station in life held by her family. That is, women in the artisan class should receive no formal education, while in the higher classes they should be trained at home, much as the boy was trained by the state.

Thus we see that Aristotle, like Plato, recognized differences between people. He appreciated that some were defective, while others were endowed with reason in different degrees. Although he advocated the same kind of training for all citizens, that did not mean they were all equal. Through training some arrived more nearly than others at the ideal life of leisure and reflection. There was a diversity of capacity and a diversity of accomplishment. Aristotle's ideal state was to be composed of such a diversity of people. In many senses at least it was a more practical and modern point of view than that proposed by Plato.

Another early clear statement of individual differences is to be found in the *New Testament*. In the parable of the talents, there is a clear recognition that some men are given one talent, while others are given two and still others five. The practical admonition given in these parables is to go out and earn other talents.

Since there is no attempt here to give a complete account of the history of individual differences, little mention will be made of the period before, during, or for some time following the Middle Ages. Yet in a very real sense the whole period was one whose main structure was permeated with the recognition of differences. This was true both of church and state, the two chief institutions of the times.

The church was arranged as a hierarchy, extending from the Pope down through cardinals, archbishops, bishops, and priests to the humblest worshipper. Each had his own duties and responsibilities. Feudalism was based on a combined political, social, and economic classification of the people, ranging from the powerful barons to the humblest serfs. In close league with this feudalistic system was the more strictly political organization of the state, with the king and his retinue of court followers. But with all this organization there seems to have been little discussion of actual human differences. It remained for Rousseau,[2] about the middle of the eighteenth century, to stress the fact that men differ fundamentally from one another. His thesis was that the child should be studied but at the same time be allowed to develop naturally according to his own bents or interests. Rousseau's influence was profound and had a large part in shaping the new movement in education away from the old formalism toward a new empiricism. It is paradoxical at least that while Rousseau stressed human differences, his writings have been said to be one important source for the French Revolution with its watchword "Liberty, Fraternity, Equality." While the equality for which the French peasantry fought was principally a political equality, there gradually arose a theory of the general equality of men. This theory has pervaded the thinking of the average man down to the present time.

---

[2] Rousseau, J. J., *Emile*, New York, Dutton, 1925. Translated from the French by Barbara Foxley.

From the French writers of the pre-Revolutionary days, Jefferson obtained his idea of political equality. In them we find the source of the statement in the Declaration of Independence that "all men are created free and equal." Although it referred to political equality, this idea has no doubt strengthened the idea of general human equality in this country.

## Beginnings of Experimental Study

About the middle of the nineteenth century two men began publishing the results of studies which have had a great, even if indirect, influence on the problem of individual differences. We refer to the work of the two German psychologists E. H. Weber and G. T. Fechner.[3] These men were primarily interested in the problem of the relation between mind and body. Their studies on the mind-body problem culminated in the famous Weber-Fechner law.

But of much more interest for our purposes is the development of the methods of psychophysical measurements, because they have since been adapted for the study of individual differences. The most important of these were: (1) The method of just noticeable differences (j. n. d.), sometimes called the method of limits. By this method it is possible to determine how much two stimuli must vary in order to be distinguished as different. For example, it has been found that on the average a person can just distinguish the difference between a fifteen- and a sixteen-ounce weight. (2) The method of right and wrong cases or constant stimuli. By this method each variable is compared several times with a standard. The point at which fifty per cent of the judgments are correct is considered the limen. (3) The method of average (mean) error. By this method the variable is compared with the standard and the point at which they appear equal is determined. Several different comparisons are made. The difference between the average values of the variable and the standard gives the average error. For example, lines are drawn so that they seem the same length as the standard. The lengths of these lines are averaged and the difference between their average length and the standard is the average error.

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[3] Fechner, G. T., *Elemente der Psycho-Physik,* Leipzig, Breitkopf und Härtel, 1889.

Although much of Fechner's and Weber's work and the work of their followers have been highly technical and abstruse, in many cases it has resulted in the use of these methods and others developed from them in educational and mental measurement. Fechner and Weber never used their methods in measuring individual differences. But many years later Seashore, in his tests of musical talent, used a Fechner technique in such things as finding the number of successful judgments in comparing pitches of varying degrees of similarity. Thorndike, in his scales for measuring handwriting and English compositions, used the method of just noticeable difference. More recently Thurstone, in some of his scales, adapted some of Fechner's methods in measuring many sorts of attitudes.

About the same time that Fechner was developing his methods in psychophysics, an English psychologist was beginning the first experimental attacks upon the problem of differences. In 1869 Francis Galton[4] published his *Hereditary Genius.* This marks the real beginning of the empirical as contrasted with the earlier practical and theoretical attacks upon the problem. Galton not only developed a method for studying differences but later evolved a method of comparing sets of data which was the forerunner of modern methods of correlation. The works of Galton and his immediate successor, Karl Pearson, are so important that they will be discussed in more detail in the following chapter.

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[4] Galton, Francis, *Hereditary Genius,* New York, Macmillan, 1869.

About the beginning of the present century, three techniques in the fields of psychology and education were introduced, each of which has had a profound influence on educational theory and practice. These were: (1) mental tests; (2) educational tests; and (3) flexible promotion in the schools.

### Mental Tests

We sometimes get the impression that mental tests were a sudden invention of Binet and Simon[5] in 1904. The work of these two men was merely the successful culmination of much earlier work. Many psychologists had been experimenting with tests before this time, and considerable work had been done with tests of simple mental processes. This work was first started by Galton and extended by Ebbinghaus and Kraepelin in Germany, and by Cattell and Jastrow in this country.

Most of the early tests were of the sensory type. Galton constructed a whistle by which the upper limits of audition could be measured. Jastrow tested visual acuity and color blindness. He and Cattell both measured the span of material that could be recognized by a very brief exposure with the tachistoscope. These latter tests really were as much tests of attention and perception as they were sensory tests. Kraepelin used several other perceptual tests, such as naming letters as rapidly as possible, certain cancellation tests, and proofreading tests.

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[5] See Peterson, Joseph, *Early Conceptions and Tests of Intelligence,* Yonkers, New York, World Book Company, 1925.

One popular test, first used by Galton, was to test one's imagination. Galton had his subjects recall the breakfast table. He found great differences, not only in the amount that could be recalled but also in the sensory field used to recall. Some visualized the table in their imagination, while others heard the clinking of the dishes. Some recalled the odors of the food and yet others recalled mostly in kinaesthetic terms.

Many different kinds of motor tests were used. Cattell constructed a kind of target-hitting test. Tapping tests were often used. Steadiness tests of various kinds were constructed. Many kinds of memory and learning tests were used by different investigators. Physical measurements, such as size and weight, as well as cranial shape and capacity were studied. This was a period of groping after whatever sort of clue seemed hopeful for the measurement of mental ability. Most of these clues proved valueless. Binet himself was one of the chief students of these problems; he even studied palmistry in his search for tests of mental ability.

In 1904 Binet and Simon were given the task of determining which children in the Paris schools were capable of benefiting by special instruction. This commission, given by the Minister of Public Instruction of Paris, made no mention of mental tests, but the results of Binet and Simon's study produced the first successful test of mental ability. Instead of constructing simple tests, Binet and Simon constructed tests of complex mental functions. For example, the children were shown pictures and were asked to tell about them. Among other tests were definitions of familiar words, such as *house, horse, fork,* and *mamma,* the repetition of a series of numbers given verbally, and the discrimination between two weights.

Some of the tests were new. Many were taken from the studies of other workers. The test items were taken from practical life situations or were new to the child. Few school problems were included. The test constructed by Binet and Simon in 1904 was composed of thirty questions. The first ten questions were for "idiots" or children up to four years of age, the next thirteen were for "morons," and the last seven were for the more advanced levels of intelligence. While the tests were given to a total of nearly two hundred children, the standards were based on the results of only about fifty normal children (about ten of each of the following years: three, five, seven, nine, and eleven) and a small group of feebleminded children in a near-by institution.

One principle formed the basis of the Binet tests. It is technically called the age-grade idea. This means that at any age the normal child has arrived at a certain grade of ability commensurate with that age. That is, a normal child of six years knows certain things and can do certain things that a five-year-old child cannot. Simple as the age-grade concept is, it has proved one of the most important discoveries in the field of modern psychology.

In 1908 the Binet-Simon tests were revised. In the revisions the tests were divided on the basis of age. There were five tests for age three, four for age five, and so forth. Age thirteen was the highest for which the new scale was constructed. With this revision a new concept was added. Since the test was divided according to years, the results of the test were expressed in terms of the passing of the test for any one year, and the child tested was given a *Mental Age* (M.A.) of the highest year for which tests were passed. Thus, a child who passed up to and including the five-year tests, but no further, had a mental age of five years. This was a much more advantageous method of expressing mental maturity than any previously used.

In 1916, and again in 1937, Professor Terman[6] of Stanford University revised the tests. Terman added several new tests and assigned a definite number of tests for each age. Starting with three years, there were six tests for each year below ten, and eight in all but one test above that age. Terman added one important concept to the measurement of mental ability: he divided the mental age of the child by the actual or chronological age to obtain the Intelligence Quotient (I.Q.). This concept is so generally understood at present that no special description is needed here. Suffice it to point out that normally the I.Q. remains constant or nearly so up to old age.

The tests thus far described are individual tests—that is, they are to be given to one individual at a time. The tests generally take from thirty minutes to an hour each. With our entrance into the World War, there was a demand for an intelligence test that could be given to several persons at once. The result was the construction of the first group test, the Army Alpha. Since the construction of Army Alpha, other group tests have been developed for different ages and for different groups of people.

Group tests differ from individual tests in other ways than in the number to whom they are given. They are composed of a series of questions or problems, each of which carries a certain weight or value. For example, Army Alpha contains 212 questions and each question correctly answered receives one point of credit. A person may therefore make any score between 0 and 212 on the test. A score on such a test means nothing except as standards are developed for the test. Army scores on the Army Alpha were classified as follows:

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[6] Terman, L. M., *The Measurement of Intelligence,* Boston, Houghton Mifflin, 1916.

TABLE I

Classification of Army Alpha Scores

| *Grade* | *Score* | *Percentage of Army Receiving This Score* |
|---|---|---|
| A | 212—135 | 3.5 |
| B | 134—105 | 7.5 |
| C+ | 104— 75 | 13.5 |
| C | 74— 45 | 21.5 |
| C— | 44— 25 | 22.0 |
| D | 24— 15 | 22.0 |
| D— | 14— 0 | 10.0 |

Other norms were established for college groups and for different age groups. Norms were also determined for many different professional groups.

Some other tests were constructed which were better fitted for elementary-school pupils, while still others were developed for use in high schools and colleges.

It is not the purpose of this chapter to discuss the uses of intelligence tests. It is, however, important to point out the fact that individual differences in intelligence, as measured by tests, are used in placing children in schools, in the promotion of pupils, in vocational and educational guidance, in the selection of students for college, in determining the relationship of intelligence to personality and behavior disorders, and in the selection of workers in industry. In other words, mental tests provide one good method for studying the problems of individual differences.

## Educational Tests

In 1897 Dr. J. M. Rice[7] reported a study in spelling at the St. Louis meeting of the National Educational Association. Rice selected fifty words and submitted the list to several different schools in order to study the effects of different amounts of drill on spelling ability. This was the forerunner of the modern standardized educational test. Not long after this, Courtis began his studies in arithmetic. Ayres and Thorndike constructed scales for measuring handwriting. Others investigated reading, English composition, and in fact all the school subjects. The elementary school subjects were investigated first, partly because they were easier and partly because the elementary school program was much larger at the time that the tests were being constructed. Standardized tests have since been constructed for nearly all high-school and many college subjects.

School tests had, of course, been in use long before this time, but these new types of tests differed in two important respects from ordinary school tests. First, some definite principle or method was used in selecting the questions. For example, in the Ayres Spelling Scale the author, after a very extensive survey, selected the 1,000 most commonly used words in the English language. These he arranged in groups of equal spelling difficulty, as determined by extensive experimentation. Second, definite standards of attainment had to be determined. Age and grade norms were usually presented with the tests. For example, it was found that the average third-grade child should spell 98 per cent of the words in Column E of the Ayres spelling test.

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[7] Rice, J. M., "The Futility of the Spelling Grind," *Forum*, Vol. XXIII (1897), pp. 163–172 and 409–419.

Several other criteria have been set up for judging a good standardized test. They should be *objective, reliable,* and *valid;* but these criteria do not distinguish standardized tests from other good tests.

Standardized tests have had some significant effects upon educational practices. By means of standardized tests it is possible to find the standing of any child in relation to his age or grade. It is also possible to compare one school or one school system with another. In fact, only by means of standardized tests can accurate studies in individual differences and differences between groups in educational accomplishment become possible.

### Flexible Promotion in School

In connection with the construction of the Binet-Simon tests, it was mentioned that these men were given the problem of determining what pupils in the Paris schools needed special instruction. This was a clear recognition of individual differences in school ability. In 1909 Leonard P. Ayres published a little book entitled *Laggards in Our Schools.*[8] In this book Ayres pointed out that, in the thirty-one cities studied, slightly more than one third of the children in the schools were overage. He found that the typical child spent ten years in completing the eight elementary school grades. For every child who made eight grades in less than eight years, eight or ten children required more than eight years to complete the grades.

Not only were more than one third of the pupils retarded one year or more, but about one fifth were retarded two years or more and about one in fifteen was retarded at least three years. More than ten per cent of the total expenditure for education was for reteaching children who were repeating grades. Largely because of studies such as this, various methods of special instruction and flexible promotions have been devised. One of the first of these was the Gary plan. One of the more recent plans which has received much attention is the Winnetka plan. Under this plan each pupil proceeds at his own rate. There is no such thing as failure in the ordinary sense of the word. The child spends as much time on each unit of work as is necessary to reach the required proficiency. He may be doing fifth-grade history and third-grade arithmetic. The children are not assigned to a single teacher but to several subject teachers. Thus a child studies history from one teacher, geography from another, and arithmetic from a third.

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[8] Ayres, L. P., *Laggards in Our Schools,* New York, Russell Sage Foundation, 1909.

High schools have devised various systems of flexible promotion to provide for differences between pupils. Some pupils take five subjects, while others take as few as two or three. Colleges, in general, have not made so many provisions for differences. One exception to this is the Chicago plan. At the University of Chicago, a student can graduate as soon as he has successfully passed the prescribed amount of work. One man has completed the usual four-year program in five quarters (sixty weeks); others may require five or more years to complete an equivalent program.

## Individual Differences in Industry

Another field in which the facts of individual differences have played a large part is that of industry and business. Following the industrial revolution in England, with the consequent division of labor, differences became much more important than they had been when the home was the center of production. With the growth of factories, there was a greater separation of employers and employees. There were also further differentiations within each of these groups.

About 1911 Frederick W. Taylor started a movement which has had the double aim of finding the best methods of production and the selection of the most efficient workmen for performing different kinds of work. While much still remains to be accomplished in each of these realms, great strides have been made both in methods of production and in selecting the right man for the right job.

### Textbooks on Individual Differences

Textbooks are of no small importance in extending any field of modern knowledge. The first text in individual psychology was *Über Psychologie der individuellen Differenzen,* written by William Stern in 1900. In this volume Stern discussed the problems of causes and methods of measuring differences. The extent of differences was illustrated by material from some of the sensory fields, as well as in other more complex mental processes.

In 1913 Thorndike[9] devoted half of one of this three volumes of *Educational Psychology* to the subject of individual differences. In this work Thorndike summarized the studies and principal theories on the subject. Since the appearance of Thorndike's text, two or three other texts have appeared treating this subject, and many texts in education and psychology have contained chapters on individual differences.

In recent years hundreds of studies have advanced our knowledge about human differences. The following chapters will summarize the chief conclusions of these studies.

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[9] Thorndike, E. L., *Educational Psychology,* New York, Columbia University, 1913.

## Classification of Individual Differences

It would be convenient if all these studies could be classified into a logical system but, unfortunately, it is very difficult to arrange them in any such classification. Nevertheless, we may consider four categories into which differences might with fair ease be placed. The ways in which people differ from one another may be classified as physical, mental, educational, and personality differences.

**Physical differences.** There are numerous ways in which people vary physically. The most obvious of these are recorded by such gross measures as height and weight. A measure such as height, of course, may be looked upon as a composite of several parts, such as leg length, body length, neck length, and head length. In addition to body length there is the length of arms and the various body diameters which are often given. Such measurements are commonly published in connection with comparisons between prize fighters and beauty contestants. There are, of course, also the various studies of physical growth in which such measurements are used.

There are also the various differences in speed and accuracy of movement. People vary in rates of tapping and in reaction time. Athletes vary in their ability to get off on the signal in the hundred-yard dash, as well as in their speed in running after the start. The total time required to complete the running varies all the way from 9⅖ seconds for the best athletes to the time required by the infirm or the young child who could only with difficulty complete this distance.

Closely related to the problem of rate and speed of movement is that of skill. In fact, skill can generally, if not always, be resolved into accuracy and speed of movement. The balance between these two factors differs from one activity to another. Skill in running a lathe and in playing golf are two rather different examples of a nice balance between accuracy and speed of movement. Health, while it is more difficult to measure, is another physical variable which everyone recognizes as varying greatly from one person to another.

**Mental differences.** While physical differences are more easily recognized by the casual observer than are mental differences, they are not for this reason to be assumed to be the greater. Mental abilities involved in problem-solving, deducing relationships from masses of presented facts, applying new rules of behavior to novel situations, and the like are considered by psychologists as very complex and as showing extreme variations from person to person. Mental tests such as the Stanford Revision of the Binet-Simon test will identify among the ten-year-old children of a large school system some who resemble in ability the average seven-year-old child and others who resemble the average thirteen-year-old. Scholastic aptitude tests given to college freshmen, while probably measuring a slightly different group of abilities, still also show great individual differences and even rather large differences among colleges. The averages of 304 colleges using such a test in 1936 distribute themselves over the middle half of all scores made.[10] (About five per cent of the colleges had medians even below the twenty-fifth percentile.) Since student bodies were not homogeneous groups, such large differences among institutions indicate much greater differences among individual freshmen.

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[10] Thurstone, L. L., and Thelma Gwinn, "The 1936 Psychological Examination for College Freshmen," *The Educational Record,* Vol. XVII, No. 2 (April 1937), pp. 252–273. Each April this journal publishes a report of the test of the previous year.

**Educational differences.** People differ in educational achievement all the way from illiteracy and ignorance at one extreme to the most highly trained teachers, research men, and investigators at the other extreme. The average educational achievement varies greatly from one country to another, and it also varies in different parts of the same country. The data of Table II indicate that there are great differences in the proportion of illiterates, even when comparisons are made among entire populations. The figures of this table show the percentage of illiterates in certain countries, states, and large cities. The populations considered are generally only those who are ten

TABLE II

ILLITERACY OF SELECTED AREAS

| *Area* | *Year* | *Percentage of Illiteracy* |
|---|---|---|
| Turkey | 1927 | 92 |
| | 1934 | 55 |
| India | 1931 | 84 |
| Brazil | 1920 | 67 |
| Mexico | 1930 | 59 |
| Greece | 1928 | 43 |
| U.S.S.R. | 1926 | 43 |
| | 1935 | 30 |
| Italy | 1927 | 26 |
| United States | 1930 | 4.3 |
| Japan | 1925 conscripts | 0.9 |
| Denmark | 1921 | 0.1 |
| South Carolina | 1930 | 14.9 |
| Louisiana | 1930 | 13.5 |
| New Mexico | 1930 | 13.3 |
| New York | 1930 | 3.7 |
| Kansas | 1930 | 1.2 |
| Washington | 1930 | 1.0 |
| Iowa | 1930 | 0.8 |
| Fall River, Massachusetts | 1930 | 10.2 |
| San Antonio, Texas | 1930 | 7.7 |
| Providence, Rhode Island | 1930 | 5.0 |
| Peoria, Illinois | 1930 | 0.5 |
| Long Beach, California | 1930 | 0.5 |

years or older. The years indicate the time the percentages were determined.[11]

Differences among American states and cities are still surprisingly large. Great differences also exist at the other end of the educational scale. In a survey of college seniors of one state, it was found that the graduates of some of the colleges knew on the average no more English, foreign language, history, mathematics, and natural science than did the freshmen of at least one of the institutions of the same state. While city, state, and college differences in educational achievement are sometimes striking, they are relatively small compared to such differences found among individuals.

**Personality differences.** People differ in still other ways than those which have already been mentioned. In addition to differences in physique, mentality or intelligence, and extent of formal education, people differ in personal acceptability, in their capacity to get along agreeably with their fellows, and in such other ill-defined traits as perseverance, aggressiveness, reliability, and moral integrity. Included under personality differences are those individual differences not included under our other three headings. It is very difficult to define precisely the abilities, capacities, and habit patterns which should be included in this classification. This difficulty of precise definition, plus the added difficulty of developing satisfactory tests, have made growth of knowledge slow in this field. However, all measurements and attempts at measurements of personality have agreed in showing that every group manifests differences and usually great differences. Individual differences in the field of personality must be as great or greater than is ordinarily supposed.

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[11] Illiteracy figures may be found in such secondary sources as *Whitacker's Almanack, National Almanac,* and the *Encyclopedia of Social Sciences.* One must recognize that the definition of illiteracy and the method of collecting information concerning it are not always the same. The percentages given above for the United States are taken from the 1930 census and are strictly comparable.

### Causes of Individual Differences

Having given a scheme for the classification of differences which may occur among persons, it is now appropriate to mention the traditional methods of classifying the *causes* of these several types of differences. The causes of differences have usually been classified under or associated with several overlapping facts of life, such as heredity and environment, near and remote ancestry, age, and sex. A moment's consideration of these categories will indicate that they are not at all mutually exclusive, but they serve very well as headings for the classification of studies in this field and may be used as topics for presenting much of the psychology of individual differences.

**Heredity and environment.** Logically, all differences may be said to be due to either or both heredity and environment, a particular difference being considered usually as due to the interaction of both heredity and environment, with one or the other predominating. The relative influence of these two types of causes has been the subject of long discussions and much investigation. A knowledge of the way in which each operates in forming differences, especially in the early part of life, is of prime importance to those interested in education, for such knowledge not only suggests methods but sets the limits of possible change which may be expected by the process of education.

**Near and remote ancestry.** The relative influence of near and remote ancestry has at times been used as the framework for discussing certain individual differences. Discussions of near ancestry are concerned with the extent to which differences and similarities are to be found between and within small family groups, while remote ancestry deals with the subject of race differences. While such discussions might at first thought be understood to be a subtopic of heredity, this is scarcely the case. In spite of having much in common, ancestry and heredity are not synonomous. A consideration of ancestry, whether near or remote, is likely to include social, cultural, and in individual cases even biological factors not included by heredity.

**Age differences.** Age differences, though difficult to place in logical relationship with the causes of differences, is a useful classification of a large number of differences. What are the characteristic differences among persons of 5, 10, 15, 25, 45, and 75 years of age? When does mental growth stop? Is mental maturity reached at the same age by everyone? If not, can the age at which mental maturity is reached by individuals be associated with any other facts in their lives, such as relatively early or late arrival at physical maturity, or with their intelligence? Do children develop psychologically at a uniform rate? If not, what are the periods of rapid growth, and are these the same for every child? Such questions as these are considered in an exposition of age differences.

**Sex differences.** It is not surprising that any division of humanity so universally made as that of male and female should be associated with the fact of psychological differences among individuals. The popular assignment of characteristic mental traits to women as opposed to men is enough to account for the traditional consideration in psychology of sex differences. In addition, there are practical reasons for the consideration of differences in relation to sex. If women, for example, are inalterably different from men psychologically, then we must not try to give girls the same kind of education as boys. If, on the other hand, fundamental differences in mentality between the sexes are found not to exist, we may, in so far as our organization of society permits, give the same education to both. Detailed consideration will later be given to the question of sex, age, race, and family differences, but in the next chapter only heredity and environment will be considered under the heading "Causes of Differences."

### Exercises

1. Point out some examples of recognition of individual differences in early times.

2. Make a list of the traits, physiological and psychological: (*a*) in which men are not born equal; and (*b*) in which they are born equal.

3. Name and describe the three methods of psychophysical measurement.

4. What were some of the predecessors of the "mental test" of Binet and Simon? In what important way did the test of these men differ from those of their predecessors?

5. Explain what is done when a test is "standardized."

6. What exactly is a "mental age" of six years? What is meant by "I.Q."? What was Terman's contribution in this field?

7. Describe and distinguish between: (*a*) individual and group tests; and (*b*) mental and educational tests.

8. If, in constructing a spelling test for eighth-grade children, only rather difficult words are used, what type of a distribution of scores will be obtained? What type of score will be obtained if all the words used in the test are easy? How are test constructors guided in their selection of words for a spelling test?

9. Describe a test which is objective and one which is not.

10. Suggest some reasons for the great number of overage pupils found by Ayres in his study of the school children of thirty-one cities.

Why would you expect to find fewer retarded pupils in a school system providing for flexible promotion?

11. How has the fact that certain colleges pursue a policy of selective admission made systems of flexible promotion less necessary, perhaps, in college than in grade school?

12. Give examples of the recognition of individual differences in industry. What are some of the methods or processes operating to get men placed in the work for which they are suited?

13. Give several methods of classifying individual differences and show that these are not mutually exclusive.

14. In what type of college would you expect to find freshmen who make high test scores: old or new; large or small; public or private? Describe the type of college which would be expected to have unusually gifted freshmen? Is the social value of a college determined to any extent by the intelligence of its freshmen?

15. Offer explanations for the differences in the percentage of illiteracy between: (*a*) the United States and foreign countries; and (*b*) the different states and cities of the United States.

16. As contrasted with general psychology, what is the subject of study of differential psychology?

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## CHAPTER II

# The Causes of Differences

### The Problem of Heredity and Environment

The innumerable ways in which people differ from one another may be attributed to one or both of two causes. All differences between persons are due to varying combinations of heredity and environment—to different combinations of nature and nurture, as is sometimes said. Although these causes seem easy enough to define, tracing their influences in particular instances is by no means easy, and as a result, many opinions are held as to the relative influence of each.

Lamarck was an early biologist who stressed the importance of environment. Like many others of his day, he believed that environmental factors play a large part and even have a direct influence upon heredity. In fact, he believed that acquired characters are inherited. Later the doctrine of the inheritance of acquired traits was discredited. Then there arose an opposing doctrine which held that the germ plasm remains immutable from one generation to another. While the body cells may be changed by environmental influences, each offspring receives from each of its parents a pure unmodified gamete. People differ in heredity because they come from different stocks, and although environmental influences may change the individual, each person passes on to his offspring an unchanged germ plasm. This latter doctrine stresses the importance of inheritance in explaining the differences between people.

Galton was the first man to make a serious experimental attack upon the problem of the relative influence of heredity and environment. As will be pointed out in a later chapter (VII), Galton believed that most differences are due to heredity. He produced a large body of evidence to support his point of view. Many later workers have held similar views. Davenport is a modern biologist who subscribes to such a doctrine. He, for example, believes that such things as mentality, personality traits, and even criminality are inherited according to the Mendelian laws. Terman, a psychologist, has held much the same view, at least as regards intelligence.

Contrasted with these beliefs are those of biologists like Child and psychologists like Holt and Watson. Child explains even such things as embryonic development in terms of physiological gradients. These gradients are differing rates of growth, which are largely controlled by environmental influences. Holt attempts to explain such things as reflexes in terms of prenatal experience. Watson's extreme position on the importance of environment is summarized in his famous saying: "Give me a dozen healthy infants, well formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select, . . . doctor, lawyer, artist, merchant-chief, and yes even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."[1]

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[1] Watson, J. J. B., *Behaviorism,* New York, Norton, 1930, p. 104.

Between these two opposed points of view is the great group of scientists who believe that both nature and nurture play a significant part in man's physical and mental structure. In general, it can be said that the biologists emphasize the hereditary factors in man, while the psychologists and the sociologists stress the environmental influences. However, even with these emphases most students of the subject, at least when questioned on the problem, admit that both heredity and environment play important roles in man's makeup.

But this middle-of-the-road point of view does not solve the problem. Granting that both nature and nurture are influences in human character, which predominates? More important still, since probably nature predominates in certain characteristics and nurture in others, what are those traits in which nature predominates and what are those in which nurture predominates? An even more difficult question is, how much in each case does one predominate over the other?

One may well ask why there has been so much controversy over the problem of causes of differences and as yet no certain answer. The reason is that it is so difficult to resolve the problem for purposes of experimental investigation. Whenever two variables are to be found in a problem, as is the case here, three methods of attack are possible: (1) Each variable may be studied separately. For example, theoretically heredity might be studied alone or environment might be studied alone. This method can be used in any case where the two variables are independent of each other. But since heredity and environment are not independent of but react upon each other, it is impossible to use such a method in this case. (2) One variable may be held constant while the other is varied and measured. This method can be used whether

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the two variables are independent of or dependent upon each other. However, this method is very difficult to apply in studying the relation of heredity and environment, and as will be pointed out later in studies of identical twins and orphans, it has produced some conflicting results. (3) Both variables may vary together but the amount of the variation of one must be known. But since we have no satisfactory measures of either, this method is, of course, impossible in the study of heredity and environment. Because of the difficulty of using any of these methods on the nature-nurture problem, our answer to the question of the relative importance of each in general or even in any special case must usually remain tentative. Nevertheless, some evidence has been accumulated, which will be cited in this and certain later chapters.

### The Effects of Heredity and Environment

**Family case studies.** Studies of heredity and environment may for convenience be grouped into four different types. The first of these types consists in selecting some large group of persons who are rather uniformly inferior or uniformly superior, and then studying the hereditary and environmental influences which have been operating to bring them to the same level. Many of the early studies of heredity and environment of this country may be said to be of this type, consisting in the collection of histories of such families as the Jukes,[2] the Kallikak,[3] and the Edwards.[4] One of these investigations was made of

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[2] Dugdale, R. L., *The Jukes: A Study in Crime, Pauperism, Disease and Heredity,* New York, Putnam, 1910. Also Estabrook, A. H., *The Jukes in 1915,* New York, Carnegie Institute, 1916.

[3] Goddard, H. H., *The Kallikak Family,* New York, Macmillan, 1912 and 1921.

[4] Winship, A. E., *Jukes—Edwards,* Harrisburg, Pennsylvania, Myers, 1900.

1220 members of the family of a worthless, feeble-minded man called Max Jukes.[5] Of this numerous family 300 died in infancy, 310 were professional paupers, 440 died from disease brought on by their own debauchery, 50 of the women were prostitutes, 60 members were thieves, 7 were murderers, and 53 others committed other kinds of crimes.

Another well-known family study is that of Martin Kallikak, who was the father of two lines of descent. He became the father of an illegitimate, feeble-minded son during Revolutionary War days. Of this line 480 known descendants have been traced, 143 of whom have been reported feeble-minded, 34 normal, and the remainder unknown or doubtful. There were 36 of them who were illegitimate, 33 who were sexually immoral, 24 who were alcoholic, and 8 who kept houses of ill-fame. A few years after the war, Martin Kallikak married a respectable girl of good family. Of this line 496 members have been studied, and not a serious blot has been recorded against them. Members of various professions and some businessmen were represented in this line of descent.

The Edwards family represents one of the best family histories to be found in this country. About 1400 members of this family have been studied. This list includes 13 college presidents, 60 physicians, 75 army and navy officers, many authors, judges, as well as several senators and one vice-president of the United States. Only one of them could really be called a "black sheep," and his crime was political rather than civil.

Interesting as these studies are, they prove little regarding the relative influences of heredity and environment. Both play a part, but their relative importance cannot be determined in such studies. It can be and has been argued equally vigorously that the Jukes offspring were what they were because of a bad hereditary stock, and also that they were worthless and criminally inclined because of bad environmental influences.

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[5] A more recent study of the Jukes family added another thousand cases, bringing the data up to 1915; but the facts were essentially the same as those found in the earlier study.

A better example of this type of study, used by Cattell,[6] consisted in the determination of the birthplace of eminent scientists. Cattell found, for example, that in 1906 the large majority of eminent scientists were born in New England, more than a hundred times as many as in many Southern and Western States. Cattell takes issue with Galton and Pearson of England and believes that there is not sufficient difference in family stocks to produce a hundred times more eminent men in one part of the country than in another part. Twenty-six years later Cattell found a great shift in birthplace of eminent men from New England to the Middle West. This shift seems to correlate highly with the growth of public schools and universities in the Middle West. This is all rather strong evidence in favor of the effects of environment on eminence, but it does not tell us how important it is.

**Studies of foster children.** A second type of study seeks to determine the effect of subjecting children of different ancestry to the same or similar environments. The more such children come to resemble each other the greater are said to be the effects of environment, while differences among them are usually attributed to heredity. Studies using orphans who have been in an institution together since an early age are examples of this type of study, as are those investigations which compare and contrast adopted children with their foster parents or with the true children of their foster parents. Of this latter type of investigation are the controlled studies made by F. N. Freeman[7] and his associates in Chicago, and Barbara Burks[8] in California. Freeman's study was made on foster children who had been tested before placement in foster homes and again a few years after placement. Freeman found that: (1) the earlier the child was placed, the greater the influence of the new home; (2) the longer it had been in the foster home, the greater the influence thereof; and (3) the better the home, the greater the improvement in I.Q. In the most favorable circumstances the change was as much as from 15 to 20 points. While both studies showed some change owing to a different environment, Freeman emphasized the significance of this change and Burks minimized its importance.

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[6] Cattell, J. McKeen, "A Statistical Study of American Men of Science," *Science,* new series, Vol. XXIV (1906), pp. 732–742. Also Cattell, J. M., and Cattell, Jacques (editors), *American Men of Science,* fifth edition, New York, Science Press, 1933.

**Studies of identical twins.** A third type of heredity-environment study uses persons of similar inheritance, usually of identical ancestry, as subjects and seeks to determine the effects of different environments upon them. Since, according to current biological theory, identical twins both have the same heredity, they are excellent subjects for this third type of study whenever they have not had the same environments. Newman and others[9] have studied several pairs of identical twins that have been reared apart. These studies, as well as the others previously mentioned, will be reviewed in detail in later chapters. Suffice it to say here that, while this is the most carefully controlled experiment yet reported, the results are by no means unequivocal.

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[7] Freeman, F. N., Holzinger, K. J., and Mitchell, B. C., "The Influence of Environment on the Intelligence, School Achievement, and Conduct of Foster Children," *Twenty-Seventh Yearbook,* National Society for the Study of Education, Bloomington, Illinois, Public School Publishing Company, 1928, pp. 103–218.

[8] Burks, Barbara, "The Relative Influence of Nature and Nurture upon Mental Development: A Comparative Study of Foster Parent-Foster Child Resemblance and True Parent-True Child Resemblance," *Twenty-Seventh Yearbook,* National Society for the Study of Education, Bloomington, Illinois, Public School Publishing Company, 1928, pp. 219–316.

**Experimentally controlled studies.** A fourth type of heredity-environment study, an experimental approach, uses two groups of subjects which have been paired for such variables as sex, age, grade placement, test scores, and social and economic background. One group is used as a control and the other is subjected to some special environment or period of training before both groups are tested.

The first experiment to be mentioned deviates somewhat from the principles set forth for the fourth type of study, in that two different experimental groups were compared. It well illustrates the influence of heredity on the maze-running ability of white rats. Professor Tryon[10] of California ran a group of 142 unselected rats in a maze for nineteen runs. The number of errors made by these rats varied on the average from less than one error for two runs to more than eleven errors per run. He then selected some extremely bright rats and bred them together, and some of the extremely dull rats and bred them together. All of the living conditions of the two groups were kept the same. He ran the first filial generation of each group through the maze and again selected bright and dull groups of rats for breeding. This procedure was continued for eight filial generations. The accompanying graph shows the gradual separation of the two groups from generation to generation. The first

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[9] Newman, H. H., Freeman, F. N., and Holzinger, K. J., *Twins; A Study in Heredity and Environment,* Chicago, University of Chicago Press, 1937. Also Newman, H. H., "Mental Traits of Identical Twins Reared Apart," *Journal of Heredity,* Vol. XX (1929), pp. 49–64, 97–104, and 153–166; Vol. XXIII (1932), pp. 3–18, 297–303, and 369–377; Vol. XXIV (1933), pp. 209–214; and *American Naturalist,* Vol. LXVII (1933), pp. 202–203.

[10] Moss, F. A. (editor), *Comparative Psychology,* New York, Prentice-Hall, Inc., 1934, Ch. XIII, by R. C. Tryon.

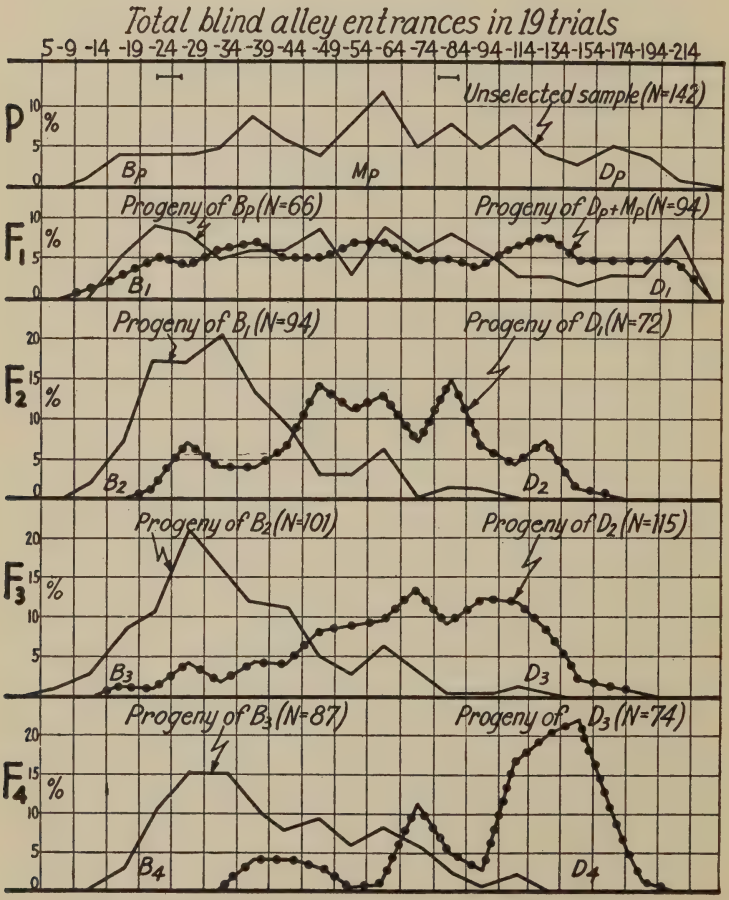

**Fig. 1.**—Effects of Selective Breeding on Maze Learning.

generation showed little difference between the groups. By the second generation, the two groups were becoming differentiated; and after the sixth, there was practically

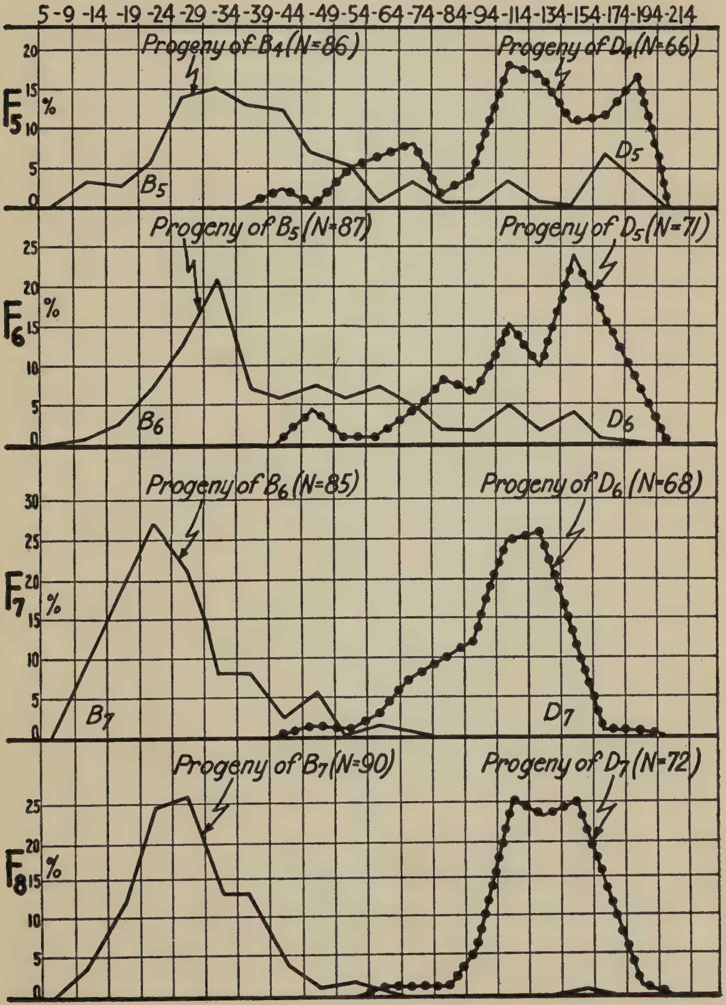

**Fig. 1.**—Effects of Selective Breeding on Maze Learning (*Cont.*)

no overlapping. That is, the progeny of the bright rats were so superior in maze-learning ability that the poorest of this group did better than all but a few of the very best of the progeny of the dull rats. This experiment proves that inheritance plays an important role in the maze-running ability of white rats.

Miss Wellman[11] conducted an interesting controlled study with preschool children. About 600 children were divided into three groups, depending upon whether they had attended preschool one, two, or three years at the Iowa Child Welfare Station. On the basis of their I.Q.'s, which were determined every six months, comparisons were made among the three groups of varying amounts of preschool experience. It was found that the 267 who attended only one year made some gain in I.Q.'s, while the 102 who attended two years made more of a gain, and the 32 three-year children made the greatest gain.[12] The gains are even more impressive when we learn that the first testing of these children yielded I.Q.'s which were definitely above average. (Their average was 111.) If, for example, the I.Q. had been only 89, one would perhaps not be so impressed by a gain. A second comparison of the I.Q.'s of these children was made by noting the gain made during the school year as compared with the gain made during the summer. Since tests were given in both spring and fall, such comparisons were easy to make. The children were divided into a number of groups, all of which showed gain in I.Q. between fall and spring and all but one of which showed small losses from spring to fall. A third comparison was between the gains in I.Q. of those who were in attendance whole days and those who attended only half days. The former group gained 10.5 I.Q. points, while the latter group gained only 4.7 points. These comparisons indicate that it is an advantage to do preschool work. Since the children of longer experience showed more gain than those of short experience, since the gains were made largely in the winter months of preschool attendance, and since the full-time students gained more than those attending half time, we may safely assume that comparisons made between children doing preschool work and children staying at home would show an advantage for the school environment.

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[11] Wellman, Beth, "The Effect of Preschool Attendance Upon the I.Q.," *Journal of Experimental Education,* Vol. I, 1932, pp. 48–69.

[12] The gains are expressed in percentiles, and the method of their use here is too involved to explain in one paragraph. Indeed, the use of percentiles in computations such as this study presents is somewhat less than ideal as a statistical procedure. Interested students are referred to the original article and to an exposition of percentiles in any standard textbook on statistics.

In a later study Miss Wellman[13] compared groups of children who had gone to the preschool and to the university elementary school with children of equal initial ability who had not attended these schools. The university-trained children showed their superiority in several ways. There was a correlation of .43±.07 between the number of years spent in nursery schools and American Council on Education scores at the high-school level, and there was a correlation of .40±.07 with college entrance examination grades. When initial I.Q. was combined with years of attendance in university schools by means of multiple-correlation technique, these values were increased to .65 and .60, respectively. Preschool children of long attendance and of average or superior ability (mean I.Q. 108.3) scored as high as other children of very superior initial ability (mean I.Q. 131) who did not go to the university school. When preschool children were matched with nonpreschool children, the difference in the scores on intelligence tests in high school and entrance examinations in college showed that in 96 and 97 cases out of 100, respectively, the preschool children's advantage represented a true superiority.

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[13] Wellman, Beth, "Mental Growth from Preschool to College," *Journal of Experimental Education,* Vol. VI (1937), pp. 127–139.

These studies certainly show that a superior environment improves the I.Q., and it is safe to say that it improves general intellectual standing as well.

## The Mechanism of Inheritance

However difficult it may be to measure the effects of environment or even environment itself, we usually assume that the same environment, in so far as it is effective, tends to make people alike, while different environments tend to make them unlike. If the inheritance of two persons is identical, the same environment then will result in their developing along the same line, while different environments for the two will tend at least to make differences between them. We commonly make the same assumption concerning heredity: like heredity makes for similarities and unlike heredity for differences. But because we have no way of knowing a great deal about the exact inheritance of an individual, there is a common tendency to identify inheritance with ancestry. By this error persons frequently think that differences between brothers must be due to environmental influences, since the brothers have exactly the same ancestry. An examination of the mechanism of inheritance should make clear the distinction which must be drawn between inheritance and ancestry, and should enable the student to see that even though ancestry is alike for two or more persons, some differences among them may certainly be attributed to inheritance.

Inheritance is controlled through the germ cell.[14] Although these cells compose but a small part of the body, it is they that determine the courses of heredity. These germ cells contain within them a substance which at one stage of cell development arranges itself into rows of easily colored material, called chromosomes. These chromosomes are arranged in pairs, and there are twenty-four pairs, or forty-eight of them, in the human germ cell. However, at one period during the ripening or maturation of the germ cells, one of each pair of chromosomes in both male cell and female cell is discarded, leaving only twenty-four chromosomes. These cells with half the usual number of chromosomes are the ones that unite at conception. Chance seems to determine which one of each pair of chromosomes is used to unite with those from the opposite sex to form a new cell. This new cell is the basis of a new human being and has the normal twenty-four pairs of chromosomes.

Characteristics are not inherited through the chromosomes as such but by smaller units called genes, of which the chromosomes are composed. Any unit character is produced by the effect of a pair of genes, one from each of a pair of chromosomes—that is, one from each parent. For example, in snapdragons the color of the flower is determined by two genes. One of these genes comes from one parent and one from the other. But they both have to play their part in determining the color of the flower of the daughter plant. Some further examples which will be given in the next few paragraphs will make these facts clearer.

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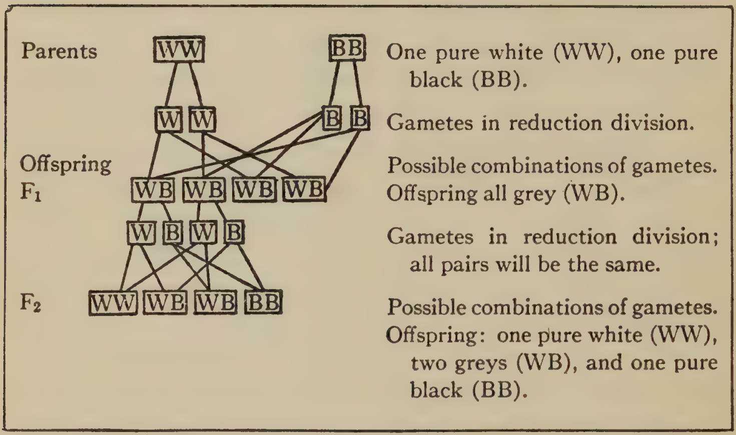
[14] The body is composed of two types of cells: germ cells and somatic cells. The first are specifically concerned with reproduction, while the second compose most of the body and seem to play no direct part in the process of reproduction.

Sometimes the effect of each gene of a pair is equal in producing the trait for which each is the determiner. In such a case there is said to be no dominance, and when the parents are alike in respect to a particular characteristic and contribute like genes for the particular characteristic, the offspring will resemble the parents in this inherited trait. If, however, the parents are different and the gene



One pure white (WW), one pure black (BB).

Gametes in reduction division.

Possible combinations of gametes. Offspring all grey (WB).

Gametes in reduction division; all pairs will be the same.

Possible combinations of gametes. Offspring: one pure white (WW), two greys (WB), and one pure black (BB).

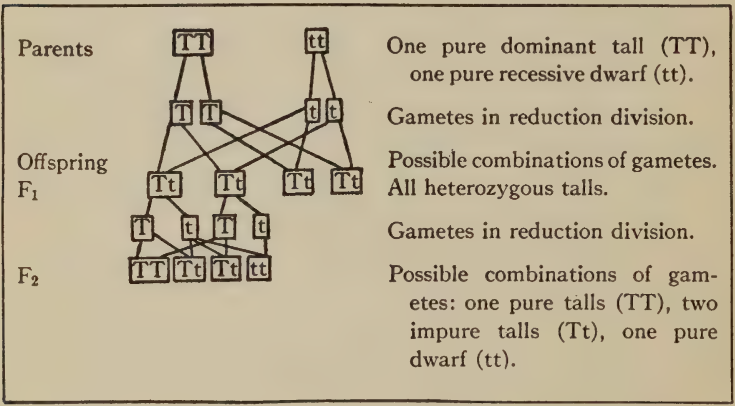
**Fig. 2.**—Simplified Schematic Representation of Reproduction in Monohybrids without Dominance. (The above is a semischematic method of representing the facts of inheritance. The top row of symbols represents some trait in each of two parents. While these traits are always bound up with others in the chromosomes, for the sake of simplicity they are treated as though they functioned separately. In the parents, each trait is represented by two letters. In germ cells, the chromosomes and the genes in them are paired. The several regular mitotic divisions are omitted here, and only the reduction division is shown, giving the unit factors represented singly in the gametes. These are shown in the second row from the top. These factors are crossed in all possible ways to give the first filial generation, $F_1$. $F_1$ is treated as parents for the second filial generation, $F_2$, and broken up into unit factors in the gametes, as shown in line 4. These are combined in all possible ways. Since all the $F_1$ are the same, only two of them are crossed. All other crossings would produce similar results.)

which each contributes is different, the inherited characteristic of the offspring is likely to be somewhat between those of the parents and not exactly like either of the parents. Although skin color is not a simple trait, it tends to be inherited in this way. When both parents have white skin color, the offspring are white; but crosses between white and black produce intermediate skin colors. See the $F_1$ generation of Figure 2.

A better example of the inheritance of a trait through two genes without dominance is illustrated in the color of the four o'clock flower. If two pure varieties of this flower, a pure red and a pure white, are crossed, the flowers of the next generation will all be pink. If two of these pinks are crossed, the offspring will be in the proportion of one red, two pinks, and one white. In Figure (3), the results of crossing the two pure varieties are shown as the $F_1$ offspring, while the results of crossing the pinks are shown as the $F_2$ offspring.

For other traits certain genes have more control over inheritance than do other genes. A gene or group of genes which exercises more control over inheritance is called dominant, while one exercising less control is called recessive. A person who has inherited a dominant and a recessive gene for a particular trait from his two parents will show only the trait determined by the dominant gene; the trait will be just as much in evidence as it would have been had his parents given him two dominant genes for the trait. The recessive trait will appear in the offspring only when both parents have contributed recessive genes for the particular trait. In cases of dominance, then, there are three possible combinations of genes but only two types of traits resulting from them. Two dominant genes, or a dominant and a recessive gene, result only in the dominant trait showing in the offspring, while two recessive genes give only the recessive trait.

Figure 3 shows the results of a cross between a pure dominant parent and a pure recessive. The first generation, $F_1$, are all alike and all resemble the pure dominant parent, but they bear a recessive gene received from the pure recessive parent. When these offspring become the parents of the next generation, $F_2$, we get the three possible combinations of genes and two types of individuals mentioned above.



One pure dominant tall (TT), one pure recessive dwarf (tt).

Gametes in reduction division.

Possible combinations of gametes. All heterozygous talls.

Gametes in reduction division.

Possible combinations of gametes: one pure talls (TT), two impure talls (Tt), one pure dwarf (tt).

**Fig. 3.**—Simplified Schematic Representation of Reproduction in Monohybrids with Dominance. (Dominant traits indicated by capital letters, recessive traits by small letters.)

A good example of dominance in human inheritance is the inheritance of shortness of fingers, brachydactyly.[15] This defect is dominant to normal fingers and has been traced in several large family groups. Marriages between normal persons and affected ones, who themselves in these cases had one normal parent, produced as many brachydactylous children as normal. Because there were no records of marriages between affected persons, we know that none of the children bore two genes for this dominant trait; there were no pure dominant brachydactylous children to become parents of the next generation. All crosses then were between Bn and nn persons.[16] Since B would occur by chance in one half of the combinations of these two, and since the studies showed that one half of the children were affected, we know that this defect is determined by a dominant gene.

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[15] For a good summary of studies on brachydactyly, see Gates, R. Ruggles, *Heredity in Man*, New York, Macmillan, 1930, Ch. VIII.

An example of a recessive trait in humans is albinism, a lack of pigmentation in skin, hair, and eyes. Because individuals of this type are easily identified and their family records can be secured for several generations, they have been rather extensively studied. Davenport[17] reports the case of a family of twelve, two parents and ten children, in which all were normally pigmented except one albino son. While both parents had the usual pigmentation in the body cells, it is apparent that each carried a recessive gene for albinism, which they both gave to the albino son. How many or which ones of the other nine children had received one gene for albinism from either father or mother, we have no way of knowing. In the descendants of any one of the normally pigmented nine siblings,[18] the recessive gene for albinism *may* be transmitted for generations until union with an albino or with a person also bearing this recessive gene may ultimately bring out the albinism in some offspring. The albino son of the family mentioned above married an albino woman, and their only child was inevitably an albino.[19]

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[16] Capital letters are conventionally used to represent dominant genes, while small ones serve as symbols for the recessives. Here, of course, B stands for the dominant gene for brachydactyly and n for the recessive gene of normal fingers. The letters Bn represent the two types of genes borne by a brachydactylous person who could transmit to his child a determiner for normal fingers.

[17] Davenport, C. B., "Heredity of Albinism," *Journal of Heredity*, Vol. VII (1916), pp. 221–223.

[18] Siblings are children born of the same parents.

To assume that the methods of inheritance are as simple as the above paragraphs indicate would indeed be quite inaccurate. Although there are but twenty-four pairs of chromosomes in a cell, there are many thousands of genes. Sometimes these genes act singly to determine what is called a unit trait, while more often they act in combination. For example, the color of the hair appears to be controlled by four pairs of genes and eye color by at least five pairs. Normally we might expect that all the traits with genes in one chromosome would be inherited together. While chance would determine which one of each pair of chromosomes a parent would contribute toward the inheritance of an offspring, the genes of any one chromosome would be expected to go together. But this does not always occur. Sometimes in the process of division preceding fertilization, when the number of chromosomes is reduced to one half the usual number, chromosomes break and some of the genes of one chromosome unite with those of another.[20] This causes traits which were formerly linked together (such as color of hair and eyes) to become separated and to be inherited from different sources.

From this discussion of the mechanism of inheritance, it must now be apparent to the reader that inheritance can easily be the cause of differences as well as similarities within a family. Because of the chance distribution of chromosomes during maturation and the union of only twenty-four chromosomes from each parent, the child will inherit half of its determiners from each parent. The traits inherited, of course, are often recessive in the parents, and it cannot be said that the child will be one half like each parent. It would be more nearly correct to say that the child receives half of his inheritance from each parent but does not necessarily resemble each parent in one half his personal characteristics. It is impossible to know from which parent any trait will be inherited.

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[19] The genes for pigmentation borne by each of the parents of the ten children were Na. Those received by the albino son were aa, while those received by the nine normal children were either Na or NN. Since the albino son and his wife each bore aa genes, their child could receive only aa.

[20] The mechanism here referred to is called "crossing over."

Siblings are on the average at least half alike in their inheritance. Of course they may be more than half alike, especially if there are characteristics common to both parents. And it is true that the parents are often alike in many traits. As an obvious example of this fact, if both parents are white, all the children will be alike in being white. One pair of siblings may be alike in certain characteristics and another pair may be alike in quite different characteristics. This is why prediction is usually impossible, except where traits are pure and alike in both parents.

### Maturation

In addition to the factors directly controlled by genes, there are certain more indirect processes which seem to take place in the normal development of plants and animals. To these processes the name growth or maturation is generally applied. There is no clear-cut distinction between these terms, but there is a tendency to use growth for structural changes, such as size and weight, and maturation for behavioral changes, such as those in swimming or walking.

Coghill[21] was one of the first persons to emphasize the importance of the process of maturation. He made a careful examination of the changes which occur in the embryonic development of the small salamander amblystoma. As the amblystoma reaches a certain stage of development, it begins to move. This movement takes place in the head region first and gradually extends to the lower parts of the body. The first activities are simple bending movements. Later the bending is to one side and then to the other. When these reversal movements become rapid and regular enough, swimming occurs.

Following the acquisition of swimming movements, the amblystoma grows legs. The fore limbs develop first and then, nearly two weeks later, the hind limbs. When the limbs have reached the necessary state of maturation, the amblystoma raises itself upon its legs and falls forward. Later, by a combination of body flexure and leg movements, walking takes place.

The most significant part of all these findings is the fact that no movements occur until the sense organs, muscles, and nervous system reach the proper stage of development. When, and not until, the appropriate structures reach the necessary state of maturity, will stimulation produce movement. As the structures mature more and as new structures evolve, further and more complicated behavior ensues.

Other studies have been made with tadpoles. Carmichael[22] placed frog's eggs in chloretone, and anesthetic which prevented all movements but permitted normal growth. When the tadpoles reached the maturity of normal tadpoles that swim, they were taken out of the anesthetic and placed in pure water. After the effect of the anesthetic had worn off, the tadpoles swam with about the same facility as animals that had been reared in the usual way. In other words, practically no experience was necessary to make these animals efficient in swimming.

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[21] Coghill, G. E., *Anatomy and the Problem of Behavior,* London, Cambridge University Press, 1929.

[22] Carmichael, L., "The Development of Behavior in Vertebrates Experimentally Removed from the Influence of External Stimulation," *Psychological Review,* Vol. XXXIII (1926), pp. 51–58.

But maturation does not cease at birth. In fact many new forms of behavior evolve at birth. Some of these, such as breathing, digestive processes, and temperature regulation, function very efficiently from the first. The structures are ready to function as soon as the first adequate stimuli are presented.

There is considerable evidence that children do not learn walking in the same sense as many other activities, such as talking. William James, nearly half a century ago, said that if anyone were inhuman enough to place blisters on the big toes of an infant and not allow them to heal till after the usual time for walking, he believed the child would nevertheless walk with little difficulty. Several experiments and observations tend to confirm James' view. In a similar manner Spaulding found that young birds that had been kept in a cage too small even to allow them to flap their wings were not only able to fly when released, but to avoid trees and other obstructions.

Sex activity is one of the last fundamental drives to mature in man. Although, as Freud has pointed out, there is some sex activity from the very beginning of life, yet sex takes on much greater significance at puberty. The other endocrine glands have been functioning even from prenatal times, but not until about fourteen or fifteen years of age do the gonads in boys and the ovaries in girls become active. The changes which occur at this time not only affect the internal organization of the person but also produce important external changes in his behavior. Many of these new forms of behavior may be considered to be the direct results of maturation.

However, a word of caution must be introduced at this point. We must not look upon all the changes that occur before and especially after birth as due only to hereditary factors. Maturation cannot take place in a vacuum.

As early as 1900 Jaques Loeb[23] was able to cause sea urchin, starfish, and frog eggs to develop into adult animals, without the usual process of fertilization. This he accomplished by several different methods, but generally by the use of weak acid followed by immersion in hypertonic sea water. Other workers have shown that if thyroid extract is fed to a certain kind of young salamander, it will develop into a land-inhabiting amblystoma. If thyroid is not fed to the animal, it will develop into a water-inhabiting axoltotl. Likewise, if thyroid is fed to young tadpoles, they will change prematurely into frogs. Thus we see that maturation itself depends upon the *interaction* of environmental factors and hereditary factors.

In his criticism of the strictly hereditary conception of development, Child[24] says:

> According to this (mechanistic) conception the earlier stages of development are determined by heredity, that is to say, the factors concerned in the construction of the machine are predetermined in the protoplasm, and only at a certain stage of development does function in the proper sense begin . . . This conception is fundamentally preformistic and fails to take account of the facts of physiology. Ac-

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[23] Loeb, Jaques, *Artificial Parthenogenesis and Fertilization,* Chicago, University of Chicago Press, 1913.

[24] Child, C. M., *Physiological Foundations of Behavior,* New York, Holt, 1924, pp. 1–2.

> tually the organism is not at any stage a closed system but is functioning and behaving at all times as long as it is active. Reaction to environment is occurring at all stages of development, though, of course, the kinds and complexity of reaction differ at different stages according to the mechanism present. Moreover, such behavior or reaction is itself a factor in development and therefore in the construction of the behavior mechanism of later stages. The behavior of the various developmental stages as well as the specific hereditary constitution of the protoplasm is a factor in determining the behavior of the fully-developed organism.

His own point of view he summarizes as follows:[25]

> In the light of present biological knowledge the only possible conclusion seems to be that the individual organism represents in each case the behavior of the hereditary potentialities of the "germ plasm" in relation to certain environmental factors.

Maturation, therefore, is to be looked upon as the unfolding of the hereditary tendencies of the organism in an environment. This environment is in turn a factor, and determines within certain limits the form and extent of the maturation process.

## The Effects of Environment

In the earlier part of this chapter the effect of heredity in accounting for differences was pointed out. Later, maturation was discussed. Under this heading it was made clear that maturation is an interaction between hereditary factors and the environment. Differences occur because maturation sets in early or late, and also because of different degrees of maturation. We shall now consider briefly how environment produces differences.

While there is something unnatural and fallacious about trying to separate heredity from environment, even for the purpose of discussion, at times we dwell upon the one as if the other did not exist. For the development of any traits in which we may be interested, both, of course, are quite indispensable. Remembering that the one does not exist in the life of a person without the other, we may say that environment affects the individual in two principal ways. First, it has some influence upon growth; second, it affords opportunities for learning.

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[25] *Ibid.*, p. 134.

**Environment and growth.** The earlier studies of the effects of environmental influences on growth failed to show much relationship between the two. Pearson and his students, for example, found small correlations (mean $r=.05$) between various socio-economic conditions and health or weight. In contrast with Pearson, Sanders,[26] in a most exhaustive survey of the more recent literature, found definite evidence of a relationship between such things as deficient food for the mother, heavy work during the gestation period, and the weight of the infant at birth. Taking only institutional cases, which did not include private cases from the higher socio-economic classes, the majority of his studies showed from five to ten per cent greater weight for the children from the better institutional group as compared with the poorer group.[27] The number of diseases and difficulties at birth show similar or even greater differences between the two groups studied. No doubt if a group of private cases could have been compared with a group from the lowest economic class, even greater differences would have been found.

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[26] Sanders, B. S., *Environment and Growth,* Baltimore, Warwick and York, 1934.

[27] It should be pointed out that a difference of five to ten per cent in means, as mentioned in the studies in Sanders' text, is not necessarily inconsistent with a correlation of +.05, as obtained by Pearson. As is so often the case in such controversies, at least part of the difference lies in the interpretation of the results. Pearson emphasized the greater significance of inheritance, while Sanders found abundant evidence of the influence of environment.

Many studies were made during the World War comparing the size of infants born in countries where there were definite food restrictions and that of children born in these same countries under normal conditions. While the evidence is not entirely consistent, most of the studies, especially those made in Germany and Austria during the latter part of the war, show that the babies born then were below prewar norms in weight.

The great difficulty with most of these comparisons is that no allowance has been made for any hereditary differences between the groups studied. Quite often the lower classes of those studied in the United States include a fair percentage of immigrants' children. Since recent immigration has been especially from Southern Europe, where the stock is smaller, the presence of these children in studies of poor environment groups will tend to pull down weight and height averages. In such cases hereditary factors are playing a part in producing differences. This word of caution should not, however, be interpreted as implying that food, health, excessive work for the mother or young child, and poor living conditions do not have their effect upon growth. When conditions become very bad and remain so, they will produce dwarfed growth. Only under good or at least fair environmental conditions will unimpaired growth take place.

**Environment and learning.** The second effect of the environment on the individual is related to the changes in behavior which we ordinarily call learning. It is no doubt true that the capacity to learn is inherited. That is, nature sets a starting point as well as the limits of attainment. There are great individual differences in the point at which learning begins, and these differences are often increased by training. We also vary not only in *how much* we can learn but in *what* we learn. Education, both formal and informal, must be considered. The whole gamut of information, habits, customs, and skills, as well as emotional attitudes, come within the scope of the influence of the environment on the individual.

Learning accounts for many differences among people. Men with equal native ability vary both in the amount they learn and in what they learn. It is probably fair to assume that the average ability of men in the several major professions is about the same. However, in attitudes and kinds of knowledge, and because of cultural and educational influences, they vary greatly from one another. Thus it is clear that environment is one of the great influences in making people different. We are what we are because of the effect of various forces about us. These forces mold us within the limits set by nature for each of us.

**Effect of training on differences.** What is the effect of training on individual differences? Does training increase or decrease differences? Simple as this question seems, it has given some of those that have studied it so much difficulty that they have given it up as impossible of solution. One of the difficulties is defining what is meant by equal amounts of practice. Does equal amount of practice mean an equal amount of *time* spent in practice or does it mean an equal amount of *material* practiced? If a slow learner and a rapid learner practice an equal amount of time, the rapid learner will have an advantage over the slow learner, and such practice will result in a greater difference between them. On the other hand, if the slow learner is given practice on an equal amount of material, he will get more practice than the rapid learner and the two would be likely to be nearer together at the end of the practice than at the beginning.

Another difficulty lies in determining the effect of training on differences. There are two principal ways of calculating gains. By one method practice increases the amount of difference and by the other method it decreases the difference. The arguments in favor of one or the other are too technical to present here.[28] Suffice it to say that the majority of writers seem to believe that, as a rule, training increases rather than decreases the extent of differences. It is also generally believed that the broader or more complex a function, the greater the effect of practice. For example, practice would cause greater differences in such a skill as tennis than in rate of tapping.

### The Nature-Nurture Problem Again

In concluding this discussion, let us return to the original problem of the relative importance of nature and nurture in man's development. That this is not a simple problem for which one answer may some day be available must now be evident. Schwesinger,[29] who has given an excellent exposition of this problem, points out that different traits not only have different ranges or degrees to which they will respond to environment but that some respond much more readily than do others, and that it is likely that a given trait in one person may not have the same susceptibility to environmental influences as it has in another person. As an example of the differences to which different traits will respond to environment, all will agree that eye color, height, and visual acuity can be much less modified by environment than can pigmentation of skin, weight, and a particular type of perception. Pigmentation of the skin certainly changes much more with a change of exposure to light than does pigmentation of the eyes; weight responds more to a changed environment than does height; and perception is so dependent upon previous experience that it is much more a function of environment than is visual acuity. As an example of differences in susceptibility of different persons to environmental influences, we need only to mention that some people profit very much more by a given amount of training than do others. The fact then that we are interested in different traits, as well as different human beings in different environments, obliges us to realize that there must be many answers to the question of the relative contribution of environment in determining differences among people. We need not, however, despair of determining the relative influence of environment in certain rigidly defined situations. If we can assume that identical twins have the same inheritance, and if all our trait measurements are accurate, we can assume that any differences found between the members of a pair are entirely due to environment. On the other hand, differences between fraternal twins[30] of the same sex who have lived together may be attributed largely to heredity, even though there is no difference in ancestry. Certainly the extent to which fraternal twins exceed true twins in amount of differences between members of a pair may be attributed to heredity. In so far as it can be assumed that orphans who have lived together in an institution since an early age have been treated alike and have been given the same environment, we can say that differences among them are due to heredity. Most other groups with which we might be interested are not so easy to define, and the effect of environment in making differences among them is not so easy to determine.

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[28] For an excellent discussion of the effect of practice on differences, see Anastasi, Anne, "Practice and Variability," *Psychological Monographs*, Vol. XL, No. 5 (1934).

[29] Schwesinger, Gladys C., *Heredity and Environment*, New York, Macmillan, 1933.

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[30] Fraternal twins are developed from two fertalized ova and, as far as heredity is concerned, are no more alike than two siblings born at different times.

### Exercises

1. What do you consider to be the problem of heredity and environment? Are there many such problems or is there but one?

2. We are interested in the effect of heredity and environment on the ability to: speak English; earn a living; be a respectable citizen; learn easily; think clearly; or what? How does your answer to this question determine your answer to that of the relative influence of heredity and environment?

3. Show how, in considering family relationships, the problem of tracing heredity-environment factors is complicated by the fact that, as the heredity of two groups of people is found to be more nearly identical, the environment also is found to be more nearly the same for each.

4. Does Cattell believe that the growth of public schools and of universities in the Middle West accounts for the increase found in the number of eminent men in this section?

5. Distinguish between concomitant relationships and relationships which may be interpreted in terms of cause and effect.

6. Would you expect children who had grown up together from an early age in an orphanage to be more or less variable than children of a similar age group who had grown up with their parents? If the former are less variable, to what can this fact be attributed? Quote from any data which you are able to find on this subject in psychological journals.

7. Criticize or justify the following statement: "Studies of identical twins reveal the extent to which environment may make differences between people, while studies of foster siblings (unrelated children of foster parents) show how environment makes for similarities."

8. Why are identical twins reared apart considered such excellent subjects for the study of heredity and environment?

9. Offer explanations for the seasonal increases in I.Q., as reported by Miss Wellman.

10. Distinguish between inheritance and ancestry. Show how the same ancestry may result in quite dissimilar inheritance and how unlike near ancestry may result in very similar inheritance.

11. Distinguish between dominant and recessive traits. Which is more likely to persist in the race if it has negative value in mating, a dominant or a recessive trait?

12. By an explanation of the mechanism of inheritance, indicate how the differences as well as the similarities between two brothers may be due to inheritance.

13. Define maturation and show its relation to heredity and environment.

14. In interpreting studies of the effect of change of diet, show the necessity for distinguishing between *possible* and *usual* effects of environment upon growth.

15. In general, do similar environments make people more alike or more different? Does the same amount of training in a broad and complex function make people more or less alike? If *A*, who can type twenty words a minute, and *B*, who can type twenty-five, by an equal amount of practice come to type forty and forty-seven words, respectively, has the practice period made them more or less alike?

16. Considering boy twins only, give reasons for the greater similarity usually found among identical, as opposed to fraternal, twins.

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## CHAPTER III

# The Measurement of Differences

### Qualitative and Quantitative Differences

Differences so frequently observed to exist between persons may be designated as either qualitative or quantitative differences. Psychological thinking, in harmony with thinking in certain other fields, has had occasion to find that more and more of the differences formerly designated as qualitative could very well be thought of as quantitative. The difference between seeing and not seeing a thing, between experiencing and not experiencing a particular sensation, between knowing and not knowing a given fact may be spoken of as a qualitative difference, but it may just as well be thought of as a difference between some and none—*i.e.,* a quantitative difference. While perhaps there are still some differences between persons which we are all obliged to recognize as qualitative, the vast majority of differences with which we shall be concerned may be called differences in amount and are accurately described as quantitative differences. All differences, then, we classify as belonging either to the small group, the qualitative, or to the very much larger group, the quantitative.

As subdivisions under the general classification of quantitative differences we may, if we are interested in logical classification, speak of quantitative differences in a given trait where a population either: (1) groups itself about the average of the trait; or (2) groups itself about several different points along the scale of the degrees to which the trait may be possessed. That is, the differences among people in a given trait may be such that many persons are near the average, while fewer and fewer are at points more and more removed from the average; or the differences in the trait may be such that a number of mutually exclusive subgroups are formed. If this latter postulation were found to be true, we might have a number of persons low in a given trait forming a group which did not overlap with those mediocre in the trait, and leaving some degrees of ability in the trait between low and mediocre not possessed by anyone at all. The use of rulers and balances for exploring the physical nature of men and of tests and scales for studying their psychological nature has indicated that, when large numbers of persons are studied, a great many traits form distributions in which every degree of the trait from low to high is possessed by someone. The number of representatives for each degree of the trait increases as one goes from the extremes toward the middle of the distribution; persons near the average are much more numerous than those possessing the trait in very great or very small amounts.

As an example of the two possible subtypes of quantitative differences suggested above, we may contrast the current attitude of scientists toward the distribution of human intelligence among all peoples with certain popular notions relative to this subject. Psychologists generally believe that, if measured, the intelligence of all men would form a continuum from low ability to high ability, with relatively few persons at the extremes—the very low and the very high, with larger and larger proportions of the population at intelligence levels approaching the average of all men. Every imaginable level of intelligence, from the lowest to the highest, is possessed by at least a few persons, but the middle levels are much more frequent than the extremes. Whether or not we hold that racial differences exist, we believe that racial groups show great overlapping in ability, and humanity as a whole leaves no levels of intelligence unrepresented. Uncritical opinion sometimes holds that there are great differences between racial groups and, in extreme cases, uncritical assumptions illustrate our second subtype mentioned above. "Inferior" races may be considered to be entirely below the lowest of the "superior" races, and levels of ability to exist between the two races which are not possessed by a single member. This last-mentioned opinion is presented here only as a conceivable way in which quantitative differences might be found, and not as an hypothesis concerning the nature of racial differences supported by any honest students of the question.

The approach to the psychology of individual differences is definitely quantitative, and most of the publications on the subject in the specialized journals are reports of studies in which quantitative results are given.[1] In order to analyze and interpret this kind of data, statistical devices are used. The more fully these statistical devices and concepts are understood, the more easily the student can evaluate the results of quantitative studies. In the pages which follow will be found some definitions and a discussion of statistical concepts which may serve as a beginning in this field.

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[1] Some writers have pointed out that extreme differences in degree, extreme quantitative differences, may partake of a qualitative nature Water going down in temperature suddenly, at the freezing point, changes to ice; or going up in temperature, it vaporizes. While these changes do involve a change in the amount of heat, yet ice, water, and vapor are in our daily experience qualitatively different. Thus it is reasoned that beyond a certain point increase in ability makes new possibilities, which may be said to be qualitatively different from those of the average man.

## Graphs

Very frequently the significance of a large mass of data can be shown much better by the use of graphs than by the presentation of all of the individual figures. By means of graphs it is possible sometimes to indicate many facts with a few lines. To do this, however, certain conventions are used which must be understood before the full meaning of the graph is apparent. The two directions which may be represented on a plane surface are assigned various meanings, depending upon the method of presentation and the type of data shown. The horizontal direction is commonly called the base line, the $x$-axis or axis of the abscissas, while the perpendicular direction of a graph is generally known as the $y$-axis or axis of the ordinates. In our discussion of the graphs which are shown on the following pages, we shall use the terms $x$-axis and $y$-axis.

**Line graphs.** In line graphs the $x$-axis is usually used to represent *time* and the $y$-axis *quantity*. Such graphs are used to show changes in price levels, or the growth of nations or individuals, with the passage of time. In Figure 4 are shown the changes in the populations of the United States and Great Britain from 1800 to 1930. By looking at the lower left corner of the graph, we see that in 1800 both nations had fewer than twenty million people; Great Britain had about ten million and the United States had about five million. Ten years later each nation had a somewhat greater population, and between

1840 and 1850 the United States surpassed Great Britain. The graph shows that the rate of growth has been much greater in the United States. Figure 26 (page 00), showing the relation of mental ability to chronological age is not, of course, the result of measuring any one individual, but is rather the graphical presentation of current psychological opinion concerning mental growth and decline. This graph may be interpreted as suggesting that the average person grows mentally very rapidly during the first twenty years of life, reaching mental maturity at about the age of twenty-four, when he has a mental age of between fifteen and sixteen years, and then slowly declining in mental ability during the remainder of his life. Figure 5 is based on the actual experience of one person learning to play billiards, and shows the results of practice at this game. The *y*-axis represents the per-

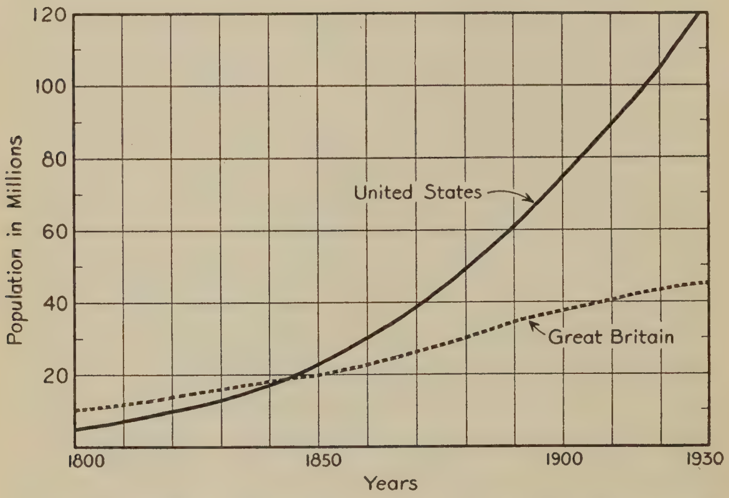


**Fig. 4.**—Growth of Population of the United States and Great Britain from 1800 to 1930.

centage of successes at each practice period and the $x$-axis designates the practice period of each 200 trials in the order in which they occurred. By close examination we see that 13% of the trials of the first practice period were successes, 24% of the second period, 22% of the third, 26% of the fourth, and so on. While the line showing percentages of successes is very irregular and has many recessions, it does show that there was some general increase in the percentage of successes—some learning was taking place. Line graphs of this type are commonly called learning "curves." If the results of practice of 500 persons were placed in one graph such as this, by taking the average percentage of successes during each practice period of 200 trials most, if not all, of the sharp points of the line showing learning would disappear, and we should have something which might very legitimately be called a curve.

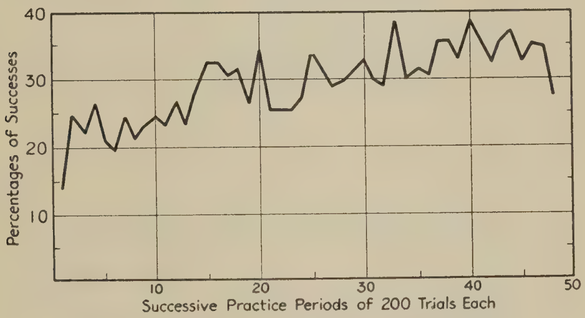


**Fig. 5.**—Effects of Practice at Billiards.

**Column diagrams.** Test scores or any set of measurements, if very numerous, can have little meaning for us when they are written as an alphabetical list of the names of the persons measured. Such measurements must be classified in some way in order to reveal their characteristics, and when grouped in from twelve to twenty classes, may be graphically presented to advantage.

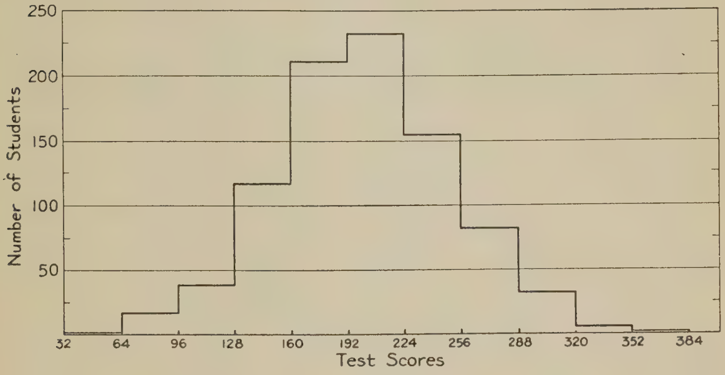
In order to illustrate the use of a graph, let us take the test scores of some students entering college. In Table III these scores have been grouped into eleven classes (called Class Intervals), and the number of students falling into each class is given. The table may be read thus: Of those students making scores from 352 to 384, there were but 2; of those making from 320 to 351, there were 5; of those making from 288 to 319, there were 34; and so forth.

TABLE III

Test Scores of Entering Students in 1932, College of Liberal Arts, Northwestern University

| *Class Intervals* | *Frequencies* |
|---|---|
| 352—384 | 2 |
| 320—351 | 5 |
| 288—319 | 34 |
| 256—287 | 82 |
| 224—255 | 156 |
| 192—223 | 234 |
| 160—191 | 211 |
| 128—159 | 121 |
| 96—127 | 39 |
| 64— 95 | 17 |
| 32— 63 | 2 |
| Total | 903 |

These same figures are represented graphically in the column diagram of Figure 6. In this graph the class intervals are indicated on the $x$-axis and the height of each column is used to represent the number of scores in each class interval or group. Instead of just setting one column next to another, this type of graph is usually drawn by indicating only the outside of the columns and omitting the lines where one column would be next to another. The column diagram has the advantage of being easy to understand, but errs slightly in indicating that the scores or measures of each interval are equally scattered through that interval. In Figure 6 we see that the class interval from 64 to 95 has a greater frequency than the interval just to the left, that from 32 to 63, and that it has a smaller frequency than the interval to the right, that from 96 to 127. Again you will notice that there are still more cases in the next higher interval and still more in the interval from 160 to 191. Above the middle of the entire distribution we find that there are fewer and fewer cases as we go from one interval to the next higher one. For example, the interval from 224 to 255 has fewer than the one just below it and more than the one just above it, that from 256 to 287. Finding an *increase* from interval to interval in the lower half of the distribution and a decrease with successive intervals in the upper half of the entire group, we might expect that similar tendencies existed within each group. In order to test for this tendency, the interval 128 to 159 was made into two intervals, one comprising 128 to 143 and the other 144 to



*After Terman*

**Fig. 6.**—Column Diagram of the Test Scores of 903 Students.

159. By examining the original data, it was found that the frequency of these two was 55 and 66, respectively. Dividing the interval 224 to 255 in a similar way, we found 86 in the lower part and 70 in the upper. Thus we see that in these two intervals at least the flat top of the columns misrepresents somewhat the nature of the distribution.

**Frequency polygons.** The difficulty mentioned is nicely avoided in the frequency polygon Figure 7, where a straight line is used to connect the points indicating the frequencies of adjoining class intervals. Since frequencies in the lower half of a distribution become greater as we move toward the center (the average) of the distribution, the frequency polygon rises and the suggestion is quite definitely made that the larger proportion of the frequencies of a given class interval is in the half nearer the average. The gradual falling off of frequencies above the average is likewise quite correctly shown by the frequency polygon.

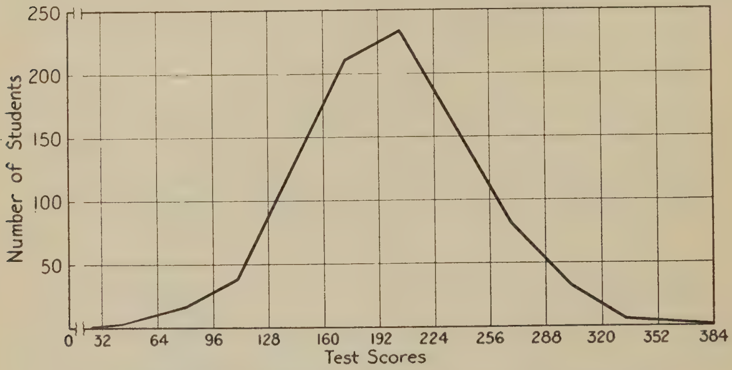


Fig. 7.—Frequency Polygon of Test Scores of 903 Students.

The frequency polygon has one minor weakness which is not found in the column diagram. Figure 8 shows the lower end of our distribution graphed by both methods and illustrates the way in which the frequency polygon (the broken line) suggests the presence of scores below 32, which are not found in the distribution.

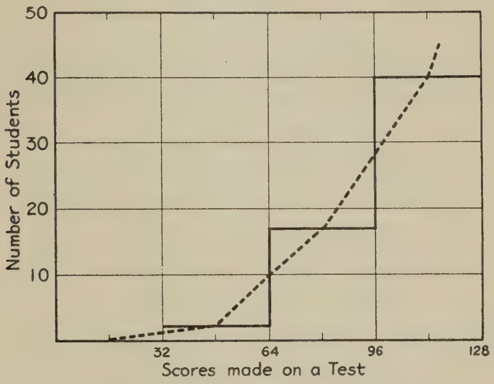


**Fig. 8.**—Combined Frequency Polygon and Column Diagram of Test Scores.

In both the frequency polygon and the column diagram, a unit of area is used to represent a unit of frequencies—*i.e.*, a given number of scores, I.Q.'s, heights, weights, lengths, or whatever is being tabulated and graphed. These two graphs, when plotted on the same $x$-axis and $y$-axis, have exactly the same total area. If we then cut off a definite proportion of a graph with a vertical line, we have cut off essentially the same proportion of the frequencies of the tabulated distribution. Both of these graphs are widely used, and if they are thoroughly understood, one should have no difficulty in understanding other methods used to present masses of data graphically.

As the number of cases increases in a frequency polygon, in general the graph becomes smoother, and for this reason investigators sometimes feel privileged to draw curved lines which only come near the points indicating class-interval frequencies. This procedure results in a "frequency curve" and is often desirable when numbers are very great. (Frequency curves are sometimes drawn when numbers are small, but under such conditions guessing is used and serious errors may result.) When data are presented in frequency curves rather than frequency polygons, it is usually because the investigator wishes to add a bit of interpretation to his distribution.[2]

**The normal curve.** One type of frequency curve which has become very well known and which is variously called the "normal" curve, the curve of normal probability, the probability curve, the curve of error, or the Gaussian curve, is of special interest to students of psychology, education, and the biological sciences. It is one of the many mathematical curves for which an equation may be written and has itself been a subject of study by mathematicians and especially by statisticians. The normal curve is a bilaterally symmetrical curve which shows a great piling up of frequencies at the middle, and we shall have more to say about it later.

Our interest as students of psychology in the normal curve is due to the fact that many of the data which we collect from large groups of carefully selected individuals do tend to fall under this type of curve. Long ago it was observed that height and many other linear measurements of the body, if collected from large groups of men, would tend to fall under a normal curve. More recently it has been found that with large groups of subjects, fairly homogeneous in respect to age, distributions approximating a normal curve are obtained from psychological data such as the number of digits which can be retained in primary memory, the proficiency in crossing out a given letter from a printed passage, the number of simple arithmetic problems which can be solved in a definite limited time, and the number of antonyms given for a long list of words. Indeed, this tendency of psychological data to fall under a normal curve has been so frequently observed that psychologists have come to believe that the native abilities of very large groups of people, if correctly measured, will give frequency polygons closely resembling the normal curve of the mathematicians. This belief is so firmly held that this form of curve of test results is often used as a criterion for the value of the test itself. If a test does not give results resembling a normal curve, or at least results falling under a bilaterally symmetrical curve, it is disqualified as a measuring instrument. The weakness of this procedure lies not so much in disqualifying tests because of their failure to give results that fall under the curve, as in accepting tests as valid because they do give such results.[3]

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[2] For additional information concerning graphs, see Arkin, H., and Colton, R. R., *How to Make and Use Graphs,* New York, Harpers, 1936; also Sorenson, Herbert, *Statistics for Students of Psychology and Education,* New York, McGraw-Hill, 1936.

Familiarity with statistical concepts is becoming increasingly important for students of the psychology of individual differences, for the subject is coming more and more to rest upon the foundation of the results of statistical studies. The following pages contain brief definitions of the more usual statistical terms or constants. The student should understand that, in order to gain a real grasp of statistical concepts, he must have experience in the actual handling of data. These definitions and comments are but the first step.

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[3] It should be noted that there is now perhaps somewhat less disposition among psychologists to assume that human abilities for large unselected groups do fall under a normal curve. It is apparent that for any group of objects of fairly uniform proportions whose one-dimensional (linear) measurement falls under a normal curve, the two-dimensional measurements (area) cannot also fall under the same curve; a disproportionate number of large measures will occur. Much less can we expect that three-dimensional measurements, such as volume and weight, fall under such a curve. (The fact that the weights of college men tend to fall under a normal curve is due evidently to lack of uniform body proportions; the short men must more often be relatively broad and heavy.) If human abilities and capacities are complex in the sense that height is complex—*i.e.*, made up of many parts, which bear an additive relation to one another—we have excellent evidence that they should fall under a normal curve. If, however, abilities have dimensional character, we may not so confidently assume that they fall under an exactly normal curve.

Practically all statistical concepts of interest to beginning students may be included under three types of information about groups of data: first, averages or measures of central tendency; second, measures of variability or degree of dissimilarity within the group; and third, measures of the degree of relationship between two traits or capacities of each member of the group.

## Measures of Central Tendency

**Mean.** Whenever a single height is used to stand for all the heights of a group, or one test score to represent a large group of test scores, such a single height or test score is some kind of an average or, in more technical language, is one of the measures of central tendency. There are three common kinds of averages or ways of obtaining a single number to represent a group of numbers. The most common way to do this, a way which every one learns in the grammar school, is to obtain the sum of a series of values and divide this sum by the number of the series. The result is the mean or, more exactly, the arithmetic mean. In popular speech the word "average" may designate any one of the three common measures of central tendency, and is consequently quite inexact. Persons making statistical investigation sometimes use *average* as a synonym for *arithmetic mean.* If a distribution is graphed on stiff paper as a column diagram or frequency polygon, and the paper is then cut out along the base line and the top of the graph, it will balance on a knife edge exactly at the mean of the distribution. The mean is a very common measure of central tendency and owes its wide usage to the fact that it takes into consideration the exact magnitude of each value in the total distribution, can be handled algebraically (if the means of the several subgroups are known, the mean of the entire group can be determined), and is well understood by persons likely to read the results of statistical studies.

**Median.** The median, another measure of central tendency, is the magnitude of the middle measure of a distribution when the whole distribution has been arranged in the order of magnitude—that is, when all the measures have been arranged from the lowest to the highest. If a group of soldiers is standing in a single row, the median height of the group is the height of that soldier who finds just as many taller men to his right as he does shorter men to his left. Or, if we take a distribution of test scores of college freshmen, we will call the median freshman test score the score of that freshman who has just as many classmates making higher scores than himself as he has classmates making lower scores. In a group of 121 scores arranged in order, of course the sixty-first would be the median score, because there would be 60 scores higher and 60 lower.

The median has a weakness in that it cannot always be rigidly defined. Where the total number of measures in a distribution is an even number, or where there are several persons near the middle having the same measures (scores, heights, or whatever is being considered), it is necessary to give the data special treatment in an attempt to make the median conform as nearly as possible to its definition as the magnitude of the middle measure when all the measures of a distribution have been arranged in the order of their magnitude. Speaking in terms of a graph, we may say that a line parallel to the $y$-axis which cuts a column diagram into two equal areas touches the $x$-axis, the base line, at the median for the distribution.[4] Because it is not based upon the exact value of each measure, the median is sometimes said to be less accurate than the mean. This weakness or deficiency, however, becomes a merit in small distributions having a few very unusual measures at one end. In such distributions the median often represents the whole group more accurately than the mean. Another merit of the median is that it can be computed when the exact values of the end cases are not known; one needs only to know at which end of the distribution they belong and their number. Sometimes an investigator finds that a small proportion of a group being studied is unable to make even a low score on the test being used. A mean could not very well be computed for such a group, but no difficulty is experienced in computing the median. In considering that relative merits of the mean and median, it must be remembered that the median of a large group cannot be computed from the medians of all the subgroups.

**Mode.** A third measure of central tendency is the mode, the most usual or most frequent measure of a distribution. In commenting upon the weather, we sometimes speak of a day of intermittent showers as being an "average" April day. Such an average is probably a mode, for we no doubt mean that this kind of a day is the most usual, the most frequently occurring type of day; it is the fashion (*la mode*) in April days. In a graphed distribution, we say that the mode is the value on the base line which is directly under the highest point of the frequency curve, frequency polygon, or column diagram. In tabulated data we take the midpoint of the class interval having the greatest frequency as the mode. The approximate mode can be obtained by inspection of data that are tabulated or graphed. It is very easy to determine the mode roughly, but since it is subject to meaningless fluctuations, it is not very often used as the sole measure of central tendency of a distribution.[5]

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[4] The bisector of most frequency polygons would be at a point very slightly removed from the bisector of a column diagram of the same data. The median usually computed for data in class intervals is the median which divides the column diagram into two equal areas, a median theoretically less than nearly perfect.

When they are computed for a single distribution, the three measures of central tendency—mean, median, and mode—often have a significance quite beyond that of any one of them alone. If the distribution gives a graph which is bilaterally symmetrical, all three of these statistical constants will coincide. If, however, there are some quite unusually high measures in the distribution, so that the graph has a long sweep to the right or upper end, the mean will have a higher value than the median and the

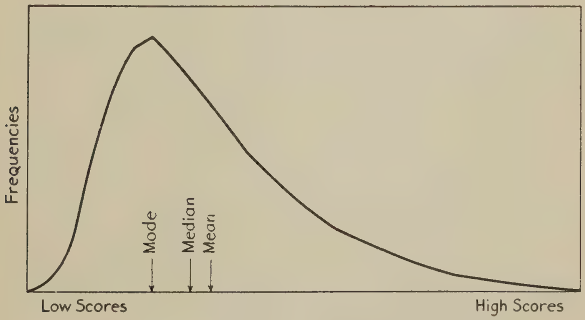

**Fig. 9.**—Curve of Positive Skew.

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[5] For an excellent statement of the relative merits of the common measures of central tendency, see Yule, G. U., *Introduction to the Theory of Statistics,* fifth edition, London, Griffin, 1919.

mode will be lower than either. Such a distribution is shown in Figure 9, and is said to be "skewed." Skewness may be either *positive* or *negative*. Distributions of this general type, which have a few measures far removed to the right from the measures of central tendency, are said to be skewed *positively*. Those with the unusual cases far to the left or lower end are skewed *negatively*. The mean, being more dependent than either median or mode upon the exact value of each measure, is pulled downward more in a distribution of negative skew than are the other two. In skewed distributions the median is between the mean and mode, resembling more the mean in value. Careful investigators often give us all three measures of central tendency for their data, and in so doing tell us something of the nature of their distributions.

### Measures of Variability

One measure of central tendency at best cannot tell us all the characteristics of a distribution of data. Two groups of children might very well have the same mean test score and yet, as groups, be quite different from each other. While both groups might have a mean of 100, the one might not have any children who were especially bright or especially dull, while the other group might have a rather large proportion of very bright children and an equally large proportion of quite dull children. In the second group the variety of abilities to be found would be very much greater. Measures of variability concern themselves with giving us some indication as to the degree of variety or heterogeneity within groups. The more common words in statistical terminology for this fact of difference among members of a group are "variability," "dispersion," and "scatter." These terms are used almost interchangeably, and one may read of measures of variability, measures of dispersion, or measures of scatter. We shall use the word "variability" and shall now speak of the common ways of designating this fact in distributions of data.

**Range.** The measure of variability which is perhaps best known to educated persons unfamiliar with statistics is the range, the difference in value between the lowest and highest measures of the entire group. In practice we usually name the lowest and highest values in the distribution being considered; thus, for example, we say that the range in temperature yesterday was from 20° to 38°. We might just as well say that the range in temperature was 18°. Like the mode, the range is very easy to obtain and is usually not very significant. The writer recently had a distribution of 5,000 measures of a physical trait, in which the range was 103; but when one measure was taken from each end of the distribution, leaving 4,998 measures, the range dropped to 92. This example may be a little unusual, but it does indicate that the range is a rather unstable measure of variability and is not to be depended upon where close comparisons are being made.

**Quartile deviation.** A measure of variability which is more to be depended upon, because it takes into account the magnitude of more of the measures, is the quartile deviation. This measure of variability is somewhat related to the median, in that we count to two points in the distribution just as we count to the middle of the distribution in determining the median. The two points on the graph of the distribution which we must determine are $Q_1$, the point which cuts off the lower 25 per cent of the distribution, and $Q_3$, the point which cuts off the upper 25 per cent of the distribution. These two points,

$Q_1$ and $Q_3$, mark the limits of the middle half of the entire distribution, and one half of the difference between them is the quartile deviation. We can define the quartile deviation then as one half the range of the middle half of the distribution. Because $Q_1$ and $Q_3$ are called quartiles, we sometimes hear the quartile deviation spoken of as the "semi-interquartile range." Like the median, this measure of variability can be computed when the exact values of a few of the end measures are not known; it is necessary to know only their number.

**Mean deviation.** The measure of variability which most closely resembles the mean in the manner in which it is computed is the mean deviation. From some measure of central tendency—usually the mean—the sum of the deviations of the measures is obtained, and this sum is then divided by the number of measures. No account is taken of the fact that some are plus deviations, or deviations upward, and others are minus deviations, or deviations downward. It is not surprising that this measure of variability has at times been called the "average deviation." Since it takes into consideration the exact position of each measure of the entire distribution, the mean deviation is a more exact measure of variability than the range or the quartile deviation. In spite of the ease with which it can be understood and its uniform dependence upon every single measure of the distribution, it is not very extensively used.

**Standard deviation.** The standard deviation, although difficult to define and very hard to visualize in any satisfactory way, is very much more frequently used than are the other measures of variability. The standard deviation is found in quite the same way as is the mean deviation, except that each deviation is squared before being added, and after the sum of the squared deviations has been divided by the number of measures, the square root is extracted. The standard deviation, variously designated as S.D. or the small Greek letter $\sigma$ (sigma), is sometimes defined as the "root-mean-squared deviation." The deviations are always taken from the mean of the distribution. Since the definitions thus far given of the standard deviation can have very little meaning to the person who has never before heard them, the concept may be enriched by learning some of the things which are usually true of the standard deviation. In many of the distributions of large numbers of psychological data, the standard deviation is about one sixth of the range. In a normal curve and in many distributions of interest to psychologists, about sixty-eight per cent of the entire distribution is to be found within one standard deviation of the mean of the distribution—*i.e.,* within a range of two sigma in the middle of the distribution. In a given distribution the standard deviation is a little larger than the mean deviation and quite appreciably larger than the quartile deviation.

## Measures of Relationship or Correlation

**Simple correlation.** Having named and defined the measures of central tendency and variability, it now remains for us to speak of measures of relationship. One of the most important which arises in psychology is the relation between two traits or facts concerning individuals. What possible relationship or correlation, as it is called, is there for example between age and general mental ability of children? Do we find that older children always, usually, rarely, or never have better mental ability than children not quite so old? An answer to this and similar questions can be given quite satisfactorily by a mathematical procedure which yields a coefficient of correlation. Let us hasten to say, however, that this mathematical expression of relationship, this coefficient of correlation, cannot be exactly computed unless the two traits or variables being investigated can be measured—*i.e.*, unless they can be reduced to quantitative terms—and also that the coefficient of correlation has very little meaning unless the two variables are carefully defined.

Coefficients of correlation vary from +1. (frequently called 100), where the relationship is perfect and direct through zero, where there is no relationship at all between the two phenomena, and on to −1., where the relationship is again perfect but now inverse. A few examples will help to clarify the meaning of these coefficients. Suppose we take for consideration a group of one hundred pairs of like-sex twins selected from a large public-school system. The relation of the age of the first twin and that of the second will be perfect, a plus coefficient of correlation of 1. If one twin is sixteen years and one month old, the other will also be sixteen years and one month. If another is six years and three months, his twin will of course be the same age. Knowing the age of one twin, we can with certainty state the age of the other. The relationship between the heights of these twins will be high but no longer perfect. If we know that the height of one twin is 54 inches, we can be fairly sure that the other twin is between 52 and 56 inches and not 64 or 74 inches tall. It is likely that the correlation between the heights of such a group of twins would be approximately plus .85. If we gave our twins a test to determine their mathematical knowledge, we might find that they still resemble each other very greatly, though the correlation might perhaps be somewhat less than for their resemblance in height—possibly a plus correlation of .70.

In order to get examples of correlations closer to zero, let us consider a group of college students who are studying both English and French. The grade which each one makes in English would be some indication as to the quality of his grade in French, but these grades would not be exactly alike in a very high percentage of the cases. There would, however, be a real tendency for those making good grades in English also to have good or at least fair grades in French. We might estimate that the relationship would be a plus .40 correlation. If the height of each of these college students was measured and placed beside the grade made in French, we should expect to find no traceable relationship. The correlation would be close to zero, because knowing the height would give one no real indication as to the quality of the French grade.

Since most psychological data yield positive correlations, we shall look elsewhere for examples of negative correlations. If we consult the weather records of a given city for the month of June over a number of years, and take as one variable the amount of sunshine for each day and as the other the amount of rainfall between sunrise and sunset, we find that there is a negative relation between the amount of sunshine and the amount of rainfall —the more sunshine on a given day, in general the less rainfall. The relationship is a negative one but not perfect, because the days of no sunshine do not always or even generally have the maximum amount of rainfall. The correlation between the two variables would be negative, probably somewhere between minus .25 and minus .60. To illustrate a perfect minus correlation, minus 1, let us take an example of only theoretical interest. Suppose a box of household matches are cut squarely across at varying distances from the head end, and that the two fragments are carefully measured and recorded as pairs.

Assuming that all matches were of a standard length to begin with and that all measurements of the two parts were accurate, then a knowledge of the length of the head end would enable us to predict precisely the length of the other end. The longer the head end, the shorter the other end—a perfect inverse relationship between the two fragments, which is commonly designated as a negative correlation of 1.

It must be noted in the foregoing examples that there were always two variables for which a correlation was assumed and that both variables were characteristics either of one person, one pair of persons, or one thing. Correlations may be computed between children's I.Q.'s and their years of acceleration or retardation, or between the I.Q.'s of pairs of sisters; but there is no correlation between the heights of men and trees, unless we can by some stretch of the imagination pair men and trees.

The degree of relationship between two variables is computed by one of several different methods, depending somewhat upon the form and number of the data involved. The symbol used to express the correlation indicates the method used in determining it. The most frequently used method expresses the coefficient of correlation as $r$, while another method uses the Greek letter $\rho$ (rho).

**Partial correlation.** Because the student will sometimes read of partial correlation, a few words will be said concerning it. If a group of grammar-school boys is given a test in arithmetic and measured for standing height, it will be found that there is a fairly high correlation between the results of the test and the heights. The taller boys will be found to know more arithmetic—quite naturally, since they are older and have studied longer. With two other coefficients of correlation, one between age and height and one between age and arithmetic scores, we can rule out the effects of age—"partial out" age, as is said—and get an expression of the relation between height and knowledge of arithmetic in which age is held constant. We have indicated to us whether, among boys of uniform age, there is any tendency for the shorter boys to be poorer or better in arithmetic than the taller boys. Such a coefficient is written as $r_{12.3}$, which means that the correlation is between variables one and two, with variable three—age in this case—ruled out or held constant.

**Multiple correlation.** Multiple correlation is another type of correlation which is sometimes, though not very often, mentioned in our studies. If we know the ordinary (zero-order) correlation ($r$) between every possible pair of the following variables for a group of students—namely, freshman grades in college, high-school averages, aptitude test scores, and achievement test scores—we can compute the multiple correlation ($R_{1.234}$) between the last three taken as a group and the first one. We can estimate the relationship of high-school averages, aptitude test scores, and achievement test scores, when combined in an optimum fashion, with freshman grades in college. Such an estimate of relationship is called a "multiple correlation," and is the relationship which two or more variables combined may have with a second single variable.[6]

## Sampling and Chance Errors

Studies to determine any general relationship between people or even the extent to which a trait is possessed by any considerable part of our population are almost always made on something less than the total group. We do not know with certainty the exact average height of American men because they have not all been measured, and for the same reason we do not know the relationship, the coefficient of correlation, which exists between fathers and sons in intelligence. Whenever attempts are made to determine such facts or to discover any general relationship, the investigators select for study a group of persons who they think will satisfactorily represent the whole population in which they are interested. If great care has been exercised to get only those subjects who are *representative* of the entire population (and this is not at all an easy task), the investigator still cannot be sure that his results are entirely accurate. It is very likely that *chance* has in some way altered them.

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[6] A good description of the methods commonly used in determining the degree of resemblance between two variables is to be found in Chapters IV and V of Garrett, Henry E., *Statistics in Psychology and Education,* New York, Longmans, Green, 1926.

Perhaps a few examples concerning representative groups and chance causes will clarify the problem before us. Any group which is selected for study and which is used to represent the larger population is called a "sample." If this smaller study group has been selected in some unbiased manner, so that it is quite representative of the larger group, it is known as a *representative* or *random sample.*[7] One interested in the average height of Americans could not select for his study the inhabitants of Minnesota, because a fair proportion of the population of this State is of northern European ancestry and tends to be tall. Even though thousands of inhabitants of Minnesota were measured and the study included many more persons than usual, we could not accept the averages obtained because the sample would not be truly representative of all Americans; it would not be an adequate sample. Or if someone sought to determine the correlation between the intelligence of fathers and sons, but disregarded all cases where there were considerable differences between the two, we could not accept his results because they would not be based on a random sample of fathers and sons, or because we would not know how much to modify his results in order to allow for the subjects omitted from this study. However, assuming that the greatest of care has been exercised in order to get truly random samples, we still find that studies, when repeated, do not usually yield exactly the same results. Ten investigators working independently of each other in an attempt to determine the degree of similarity between brothers in spelling ability would not, in all probability, get precisely the same results, even though each had the same-sized group of subjects and each had been successful in getting truly representative groups, or random samples, of brothers. And if each of the ten investigators repeated his study on another group of brothers of the same size, it is not likely that a single one of them would obtain exactly the same correlation as he had obtained in the first study. We are assuming that these slight differences in results between studies are due to *chance* causes. Similarly, when 100 coins are tossed once, not always—indeed rarely—will there be 50 heads, although the average of a great many throws will approach 50. The fact that 100 coins will sometimes give more than 50 heads and sometimes less than 50 we say is due to chance causes. In attributing these fluctuations in the number of heads to chance causes, we do not at all mean that they are not the result of appropriate causes but that the causes which determine them are very numerous, none being predominant, and that they cannot be properly traced, still less measured, apart from one another. Their effect in any one throw of the coins is quite unpredictable, but the manner in which these causes work in a great number of cases can be quite accurately described or delimited. Successive samples of American men, even though they are random samples, will not give the same averages because, as we say, these averages are subject to fluctuations due to chance causes.

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[7] A distinction can be and frequently is made between representative samples and random samples. In the former, the sample used has the same proportion of subjects from each geographical area, age group, racial group, occupational group, or sex group as the statistical universe from which the sample is drawn. In the latter, subjects are selected in some arbitrary manner, such as taking every tenth name in an alphabetical list, which is thought to be free from the influence of any of the variables being investigated.

**Probable error.** A special method has been devised to estimate the effect of chance causes upon an average, a measure of variability, a coefficient of correlation, or upon any one of a number of other statistical constants. This estimate of expected fluctuations of a statistical constant is expressed in terms of the probable error of the statistical constant. Thus you may see in a report of a study that the mean height of American men is 68.±1 (sometimes written 68 P.E. 1). The number 1 following the mean of 68. is the probable error, and may be defined as the distance above and below 68—that is, between 67 and 69—between which one can say that there is an even chance of finding the true mean, the mean of all American men. It should be noticed that the combined chances that the true mean will be above 69 or below 67 are just as great as that it will be between 67 and 69. It must also be noticed that the probable error has no predictive value concerning errors which are due to faulty investigation procedure, such as the failure to get a random sample of subjects, arithmetical errors in computation, or inappropriate application of statistical procedures. If a correlation of .47±.05 has been found between the intelligence of fathers and sons, we can say that as far as chance errors are concerned there is one chance out of two that the true relationship between the intelligence of fathers and sons lies between .42 and .52, recognizing that the true relationship may actually be below .42 or above .52. The reader may very well ask himself how far the true relationship may be above the observed relationship of $r = .42 \pm .05$. It may be almost anywhere above or below this value, but the chances are so exceedingly remote that it will be 5 P.E.'s removed from the observed correlation, that we usually set these as the possible upper and lower limits of fluctuation due to chance causes. We should say, then, that there was almost no chance that the true relationship was as high as .67.

Because terminology is not rigidly fixed in respect to the usage of the term "probable error," it will be well to point out some of the variants. Occasionally we see the phrase "probable error of a distribution." The value here referred to is very nearly, if not exactly, the same thing as was defined some pages back as the quartile deviation of a distribution. According to the more usual meaning for these terms, quartile deviation is one half the range of the middle half of actual distributions of data, whereas probable error is one half the range of the middle half of predicted fluctuations of a statistical constant. Quite often the student reads of the "standard error" in places where he might expect to find "probable error" mentioned. The two are quite alike, in that they are both estimations of possible fluctuations due to chance causes; the probable error, however, is smaller and is in fact computed from the standard error, the relation being P.E. = .6745 standard error. The standard error being larger, it is not surprising to learn that the chances are just over two out of three that the true mean, for example, lies within one standard error above or below the observed mean. While nothing has been said as to how the standard error and probable error are computed, the student must know that they are in part dependent upon the numbers used in the studies; larger groups tend to give smaller probable errors.[8]

### Certain Characteristics of Measuring Devices

The discussion thus far concerning statistical concepts has, of course, implied that these are of use in understanding individual differences. It must now be apparent that these concepts can be applied only to data which have been reduced to quantitative terms. It must furthermore be evident that the existence of data in quantitative terms presupposes some measuring devices. To understand the general conclusions of quantitative studies, it is not enough to be familiar with the statistical devices used; we must also know something about the origin of the data, about the measuring instruments with which they were obtained. Whether the psychologist in his studies has used personality scales, scales of socio-economic status, tests of emotionality, intelligence tests, or the more accurate measures of length and weight will make some difference in one's attitude toward his results, because these measuring devices are by no means equal in accuracy, varying both in reliability and validity. It must be emphasized that clever statistical manipulation of data can never be accepted as an adequate substitute for accurate measurement in obtaining the original data. Let us look for a few moments at the nature of the tests which are being used.

**Test units.** Since intelligence tests are very frequently used in studies of individual differences, they may be used to illustrate some of the requirements of a measuring device. In a yardstick, we expect each successive inch to be exactly one thirty-sixth of the entire yard; in a balance, each added ounce of weight must be exactly the same; in intelligence tests, we expect each unit of measurement to represent an exactly equal increment. Most intelligence tests are scored by giving one or more points for each correct answer to questions which are not only of greatly varying difficulty but are also of several types, and which must usually be answered in a minimum of time. It appears that tests involve not only the speed and the level of difficulty at which one can work, but also the variety of tasks which he can do.[9] The complex nature of these tests, as well as certain statistical evidence, has led most investigators to believe that the units of tests are not units in the exact sense.

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[8] A clear statement of the meaning of probable error, which should be very useful to the beginning student, is to be found in Chapter XXI of Thurstone, L. L., *The Fundamentals of Statistics,* New York, Macmillan, 1927.

A rather convincing example of "units" of mental measurements which are probably not true units are the "mental years" of those tests which are scored in terms of "mental ages." These tests use the average child of each age group as a standard of comparison for reporting the ability of the children examined. For example, a child who can answer a selected list of questions which three-year children on the average can answer is scored as having a "mental age" of three years. Similarly a child who answers questions usually answered by six-year-olds is designated as having a "mental age" of six years, one answering questions for ten-year-olds, as having a "mental age" of ten, and so forth. An average child at the age of three has a mental age of three, at four a mental age of four, at five a mental age of five, and so on, until he reaches the end of the period of mental growth. A bright child may at the age of four have a mental age of five years, at eight a mental age of ten, and so on; while a dull child at the chronological age of five (five years old) may be able to answer only those questions usually answered by four-year-olds and consequently be rated as having a mental age of four, and at ten he may be expected to have a mental age of about eight. It has been found that the ratio of mental age to the chronological age, the I.Q. or Intelligence Quotient, usually remains rather constant during childhood. Since the I.Q. remains fairly constant for a child, the line obtained by plotting the mental age against the chronological age—the mental growth line—is quite a straight line (see Figure 10). The very fact that this line is straight is the source of the suspicion that "mental years" are not true units. The straight line of growth indicates that children grow a given amount each successive year, which to most students of the problem

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[9] Thorndike has designated the three aspects of intelligence used in answering test questions as *power, range,* and *speed.*

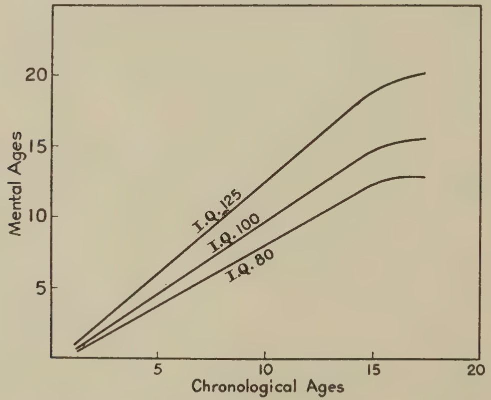

**Fig. 10.**—Relation of Mental Ages to Chronological Ages. (Here it is assumed that mental years are true units of measurement. The rates of growth of children with I.Q.'s of 80, 100, and 125 are shown.)

is an untenable conclusion, as growth curves for other structures and capacities of children are never straight lines.

**Cultural backgrounds assumed by tests.** Another aspect of the nature of intelligence tests which is sometimes important in interpreting data is that they frequently make use of questions which presuppose a certain type of experience. If a child of five does not know his family name, we can legitimately assume that he has some deficiency in learning ability, because it is quite safe to assume that he has had opportunity to learn his name. But many information questions used in tests are not so uniformly within the experience of all who undertake to answer them. In fact, a number of questions are used which are within the experience of only a rather restricted group. Obviously such questions are of little value in groups of slightly different experience, to say nothing of those of different cultural and racial backgrounds. This use of questions presupposing a particular type of experience is a source of great embarrassment in studies of sex differences, and especially in studies of race differences.

**Reliability and validity of tests.** In order that students may be aided in evaluating the results of tests, investigators frequently give some indication as to the effectiveness of the tests used. If a test or measuring device measures accurately what it purports to measure, it is said to be valid. A test of perfect validity would make no mistakes in measurement. If we had some direct way of knowing exactly the intelligence of some group of persons, this information could be checked with the test results and the absence of discrepancies between the actual intelligence and the intelligence test score of each person would indicate the validity of the test. Since this procedure is quite impossible, other means must be used in order to arrive at estimates of the validity of a test. We know that a perfectly valid test would consistently give the same results time after time for a group of individuals if we made the usual assumption that the intelligence of a person remains the same from day to day. Self-consistency, then, is used as a means of estimating the validity of a test.

Self-consistency, or reliability as it is more generally called, may be estimated in several different ways. A simple method of determining the reliability of a test is to give the test on two occasions to the same group and compute a coefficient of correlation between the results of the first testing and the second. A similar method of determining reliability is to give a group two forms of the same test and determine the correlation between the two. Since the two forms are supposed to be of the same difficulty and measure the same thing, the correlation obtained between them may be considered as a statement of the reliability of each form. Perhaps the most common method of determining the reliability of a test is by the so-called "split-half method." Two scores are obtained for each test, one for each half, and from the correlation between these scores an estimate is made as to the reliability of the test as a whole.

The reader may have already suspected that the correlation indicating the reliability of a test is dependent somewhat upon the conditions under which it was determined. For this reason we expect careful investigators to state the method of determining the reliability of the tests they have used. A coefficient of correlation indicating reliability, say a reliability coefficient of .85, is subject to interpretation. If it indicates the relationship between the results of giving the test twice over a long time interval, it probably means more than if it is an indication of reliability estimated by the split-half method. These several methods of determining reliability are used, not because we value reliability for itself, but only because we know that a valid test *must* be self-consistent and because a test of high reliability *may* be a valid test.[10]

**Arbitrary zero of tests.** Still another matter of concern in respect to psychological measuring devices is the real meaning of a score of zero. Very often, especially in the psychological laboratory, a rating of zero means no achievement whatever, and no difficulty is experienced in interpreting its meaning; but in many tests and scales a score of zero does not usually mean real zero ability. In such tests, a number of persons may get ratings of zero, though each may have something more than zero ability and each be different in ability from every other person in the group. These tests are said to employ an *arbitrary zero* and are especially unsatisfactory in experiments which attempt to show the relative amounts of change in groups of different initial abilities.

## Summary

At the beginning of this chapter we stated without demonstration that the differences with which we were concerned were largely quantitative; later we gave some of the statistical concepts useful in describing quantitative data; and, finally, we pointed out some of the features which a measuring device should have in order to give us satisfactory data concerning differences between persons. Because of the prime importance of the manner in which the original data of studies are collected, some comments concerning this subject will be made in closing the chapter. In reading the reports of studies of individual differences, the student should ever be critical of the methods of obtaining the original data. We have already pointed out the extreme desirability of having measuring devices of true units, as well as the possibility that this is not always—indeed, perhaps not often—characteristic of tests and scales now available. In addition, the student should realize that investigators, especially in studies of inheritance, should have at their disposal tests and scales which are relatively free from the influences of the special experiences of their subjects. In studies of the relative importance of inheritance and heredity, of race differences, and even of sex differences, any test or scale which gives some advantage to any subjects because of their own unique experiences—particularly if the subjects are unidentified—is of doubtful value. A third point is that measuring devices must of course have a high degree of reliability if dependable results may so much as be hoped for. Unreliable measuring devices may be expected to yield no significant results. Finally, the student would do well to remember that the zero score of most tests does not necessarily, or even usually, mean zero ability. This fact becomes important in studies such as those having to do with the relative effects of practice upon groups of high and low initial ability.

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[10] Those students particularly interested in this subject should see especially Adams, Henry F., "Validity, Reliability and Objectivity," *Psychological Monographs,* Vol. XLVII, No. 2 (1936), pp. 329–350. Also Thurstone, L. L., *The Reliability and Validity of Tests,* Ann Arbor, Michigan, Edwards, 1932.

### Exercises

1. Name some fields of learning in which differences are reduced to differences in amount and are rarely considered as differences in kind.

2. Draw a frequency polygon of the weights of an imaginary group of 400 children consisting of 100 one-year-olds, 100 four-year-olds, 100 nine-year-olds, and 100 sixteen-year-olds. How would this graph differ from one drawn for the weights of 400 ten-year-old boys? Which of the two above graphs resembles those usually found for psychological data?

3. Why should a student of the psychology of individual differences concern himself with statistical concepts?

4. In graphed data from large groups, what use is frequently made of the two dimensions of the sheet of paper? What are the common names of these dimensions?

5. Find several examples of line graphs in books or journals reporting psychological studies.

6. Why would a composite learning curve for 500 people be smoother than a similar curve for a single person?

7. What objection may be raised to the flat top of each interval as drawn in column diagrams? Is this weakness of the column diagram present when there are extremely large numbers of cases in each class interval?

8. Point out the similarities and differences, merits and defects, of the column diagram and the frequency polygon.

9. What is the difference between a frequency polygon and a frequency curve? Which is used in general discussions of the nature of distributions?

10. What is a normal curve? Why is it important in the psychology of individual differences? Give one use which is often made of it.

11. Assume that you have a large number of cubes whose sides range from one to nine inches in length, averaging five inches, and that a distribution of the side lengths falls under a normal curve. What kind of distribution would the area of the sides of these cubes make? What would be the nature of the distribution: (*a*) of their volumes; and (*b*) of their weights?

12. What is a measure of central tendency? Name and define the three common measures of central tendency.

13. For each of the three measures of central tendency, list: (*a*) the merits; and (*b*) the weaknesses.

14. Are all three measures of central tendency values on the base line? Do all three ever coincide for a given distribution? Are all subject to meaningless (chance) fluctuations in the data? If so, which is most and which least subject to such fluctuations?

15. What is a skewed curve? Name and describe the various kinds of skewed curves.

16. Give two or three synonyms for the word *variability*. Name and define the four common measures of variability, and evaluate each.

17. Define $Q_1$ and $Q_3$. What is the meaning of $Q_2$? Is the quartile deviation a measure of variability taken from the median of the distribution?

18. While the mean deviation is usually computed from the mean of the distribution, it can of course be computed from the median of the distribution. When this is the case, what is likely to be the change in the mean deviation obtained?

19. Define or write the equation for the standard deviation and give several facts concerning it in a given distribution.

20. What is a coefficient of correlation? What values may it have? What is the meaning of some of the typical coefficients which may be obtained? If large and small values in one variable are usually associated with large and small values in the other, what kind of correlation do we have? What kind of correlation results if the condition is reversed?

21. Name several conditions which must always obtain in order to compute a correlation.

22. Suppose that, for 5,000 freshmen, we have data on three variables: (1) scholastic aptitude test scores; (2) average first-semester grades; and (3) average number of hours per week of study. If $r_{12}$ is .50, what do you estimate $r_{12.3}$ to be? Give reasons for your answer. What do you estimate $R_{2.13}$ to be? Could $r_{12.3}$ and $R_{2.13}$ easily be below .50? Give your answers assuming that: (*a*) the bright students tended to study less than the dull; and (*b*) the bright students studied more than the dull.

23. Distinguish between errors due to failure to get a representative sample of a population and errors due to chance causes.

24. What is the place of "chance" in a world of "law and order"? Are chance fluctuations of a mean, for example, the direct result of appropriate causes?

25. Define probable error and standard error.

26. Name a number of causes of the fluctuation of means or coefficients of correlation to which no reference is intended when a probable error is computed.

27. Discuss the effect of faulty and inaccurate measurements upon the statistical results obtained from such measurements.

28. Why is it difficult to consider "mental years" as units?

29. Under what conditions may information questions be used to measure general ability? Are these conditions fulfilled in studies of race differences?

30. With reference to a test, what is meant by its: (*a*) validity; and (*b*) reliability? How is the validity dependent upon the reliability?

31. In what ways may the reliability of a test be determined and in what form is it expressed?

32. Give examples of studies in which mention is made of the reliability of the measuring devices used.

33. What are characteristic reliability coefficients of psychological tests?

34. Indicate the error in saying that a temperature of 60° F. indicates the presence of twice as much heat as a temperature of 30° F. What is the zero point on the Fahrenheit scale?

35. Why can we rarely, if ever, say that a test score of 60 indicates twice as much knowledge or ability as one of 30?

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## CHAPTER IV

# Differences in Physical Characteristics

### Kinds of Physical Differences

To outward appearances we are all more alike when we are born than at any later time in life. It is true that even at birth we differ in color, weight, height, health, and in many other ways. These differences tend to increase as we grow older, so that there are many characteristics by which we can distinguish each of our hundreds of acquaintances from one another.

There are several ways in which physical differences may be classified. We shall consider them under two main headings: first, the changes which occur within each individual; and second, the ways in which individuals differ from one another. Obviously people are different in physical characteristics, such as height and weight, and in many less obvious traits. The other classification—the ways in which an individual may change physically—may be subdivided into changes which take place before and after birth. In this chapter we shall consider first prenatal growth. This will be followed by a discussion of changes in the individual due to age. Next we shall study the extent of differences among people.

Changes or variation in physical characteristics are significant in any discussion of individual differences, since they constitute the most apparent basis of any classification of human differences. A second reason for stressing physical differences here is that since the units of physical measurements are so exact and the measurements so reliable, we can get some suggestions from a study of them that may be helpful in the more difficult tasks of measuring what are ordinarily termed "mental" traits. A third reason for emphasizing physical differences is the widespread notion that there is some close relationship between physical and mental traits. Many studies have been conducted to discover whether there is any important relationship between intelligence and such physical traits as height and weight or shape of head. Other studies have correlated additional physical measurements with other mental traits. The last section of this chapter will summarize some of the important studies of the extent of these relationships.

## Physical Differences During the Life Span

Each individual begins his existence as a result of the union of two germ cells. These two cells are very different in size. The egg from the mother is approximately .2 mm in diameter, a size barely visible to the naked eye. The sperm is many thousand times smaller. After the union of these two cells, growth takes place very rapidly. This first cell soon divides; then each of the resulting cells divide and continue to redivide, and so on. In fact, in the first few hours the number of cells in the fertilized ovum increases manyfold.

The ovum is at first a solid sphere, but later the cells migrate to the surface, leaving only fluid in the center. Still later there is a partial collapse of the walls forming two layers of tissue. In this form the ovum somewhat resembles a deflated hollow rubber ball. A third layer of tissue soon forms between the two original layers. During the process of growth the ovum becomes attached to the wall of the uterus and may then be considered a true parasite.

From this point on growth is more specialized. First one and then another part develops more rapidly than the rest, and soon the form of growth takes on characteristic human aspects. The following list of diagrams and drawings (Figures 11 and 12) trace in rough outline

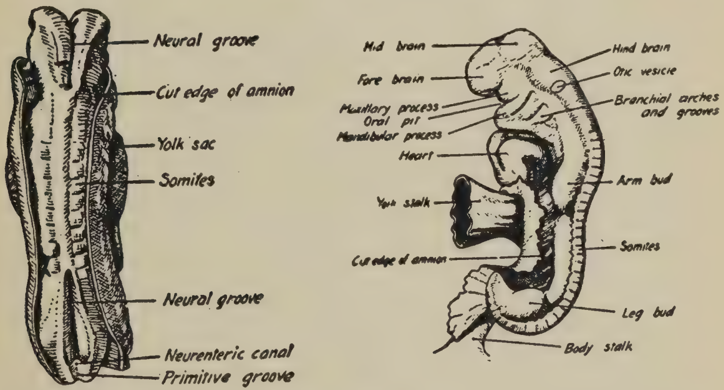

**Fig. 11.**—Two Early Stages in the Growth of the Human Embryo. (The illustration on the left shows the embryo at about 4 weeks old and 2.1 mm. long; that on the right at about 5 weeks old and 4.2 mm. long.)

the steps in this growth. By the fourth week, many internal and external parts have become differentiated and are easily recognizable. The heart has begun to form in the neck region, from whence it later migrates to the left side of the thorax. The spinal column is clearly apparent in outline and its upper end connects with the even better developed three-lobed brain. The arms and legs have begun to issue as buds from the main part of the

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body. Even the facial features have begun to appear through the formation of nose, mouth, and ears.

Henceforth growth is largely an elaboration in size and form of structures already partially developed. As organs are established, they link themselves together in functioning systems. Rapid as is the growth of parts, there seems to be great regularity and orderliness in development. Scammon[1] has made an extensive and detailed study of body growth from the third lunar month till birth. The results of his study are presented in the accompanying graph, which compares the prenatal growth with the postnatal growth of the same structures. These studies include not only the gross body weight but also the weight of the thymus, brain, testes, and suprarenal.

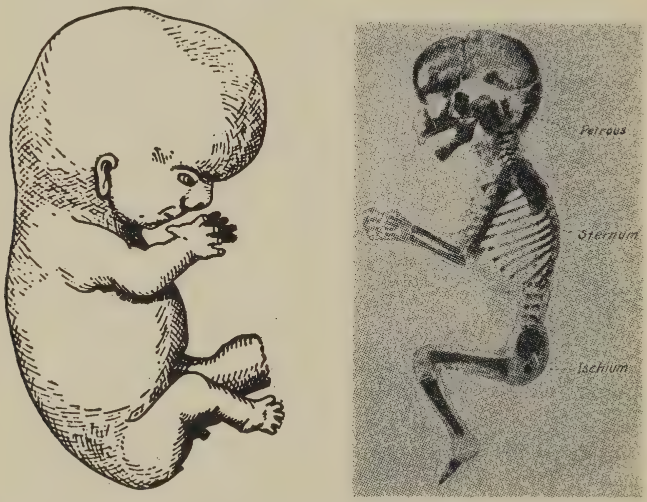

**Fig. 12.**—Two Later Stages in the Growth of the Human Embryo. (The illustration on the left shows the embryo at the age of about 8 weeks old and 23.5 mm. long; that on the right, at about 17 weeks old and 140 mm. long.)

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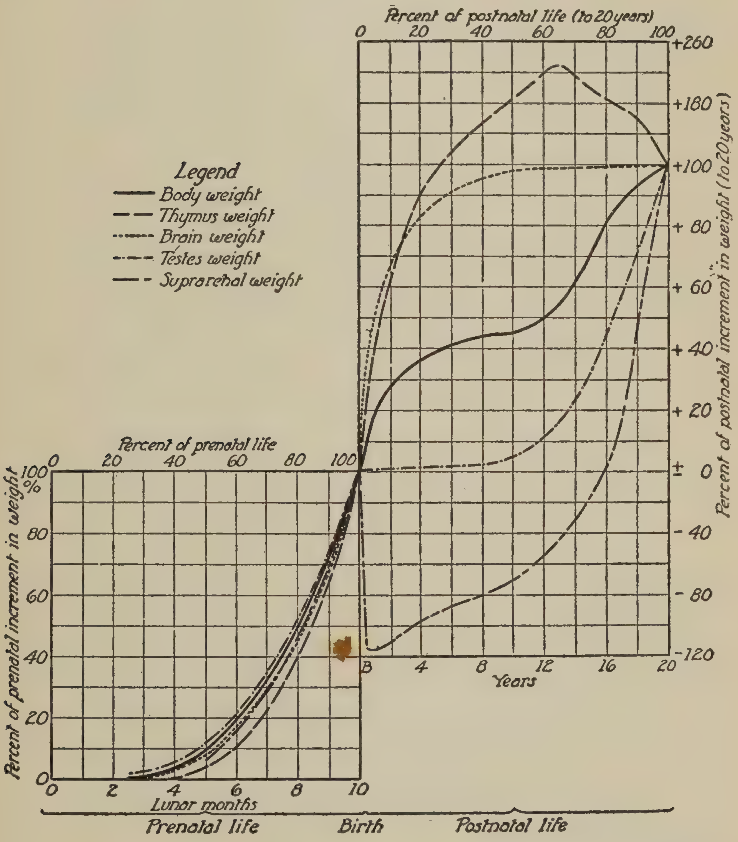
[1] Scammon, R. E., *et al.*, *The Measurement of Man,* Part IV, Minneapolis, University of Minnesota Press, 1930.

The first four measures are carefully chosen as representative of the four major types of body growth. These types Scammon calls: (1) general; (2) lymphoid; (3) neural; and (4) genital. The graphs are constructed,



*After Scammon*

**Fig. 13.**—Diagram Illustrating the Growth in Prenatal and Postnatal Life of a Series of Structures of Diverse Postnatal Types of Growth. (Reproduced by permission of the publisher from Harris, J. A., Jackson, C. M., Paterson, D. G., and Scammon, R. E., *The Measurement of Man,* Minneapolis, Minnesota, University of Minnesota Press, 1930, p. 204.)

not in terms of actual weight, but in terms of percentage of the total weight at birth. Thus for example, at the eighth lunar month these tissues will have reached about half the size they will be at birth, by the end of the tenth lunar month. On this basis, it is apparent from the graph that the most rapid growth occurs during the last part of the prenatal period. It is also interesting to note that these different tissues seem to develop at very similar rates, which is in striking contrast with their relative rates of development after birth.

At birth the average child weighs about seven and a half pounds and is about twenty inches long. The problem of human growth after birth is not so simple as it seems. Although there are some similarities, no two of the many studies of the rate of growth present exactly the same form of growth curve. Most of these curves show a rapid rise up to six or seven years, followed by a lesser rate of growth until about twelve years, after which there is another spurt for two or three more years. These differences are no doubt due, at least in part, to factors of selection in the subjects measured, rather than to actual growth changes. There are always public-school children from the ages of six to twelve available for measurement, but it is much more difficult to find groups of children below six. The kindergarten has supplied the majority of children for ages four and five, but in most cases the kindergarten population is a select group coming as a rule from the higher economic or intellectual classes. In such cases the norms for height and weight are likely to be higher than from the less selective elementary public-school children from ages six to thirteen or fourteen. The common method of selection of the young children may therefore account for the spurt in the growth curve as often shown for ages four and five.

This spurt may be an artifact rather than a true change of growth rate.

Another spurt in growth curves is generally found at about age thirteen or fourteen. While there may be some increase in growth rate at puberty,[2] it may be that another cause is responsible for the changes in the growth curve as ordinarily presented which does not represent a true change in growth rate. Just as there is a selective factor in the children who attend the kindergarten, so is there also a selective factor in high-school pupils. This factor was even much greater at the time when most growth studies were made than it is now. The selection tended to eliminate the unfit, and as Mrs. Woolley has so well shown in her study in the Cincinnati schools, those who quit school are below the school norms in both mental and physical characteristics. Therefore when norms for ages fourteen and above, taken largely from high-school pupils, are added to public-school norms for ages below fourteen, at least part of the spurt probably does not represent a true change in growth at this age and above.

What appears to be a truer picture of the normal rate of growth is presented in the accompanying graph. It is constructed from the composite measurements of fifteen different investigators. The advantage of increasing the number of persons measured for each age to thousands is that in so doing the results are almost certain to be freer from chance fluctuations. It has the further advantage of combining several different methods of selecting subjects for measurements. In this manner the distortions due to one kind of selection tend to be compensated by others of a different kind. The results probably present a truer picture of typical physical growth than any single series of measurements from which the composite is constructed.

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[2] This has too often been looked upon as an adolescent spurt. There no doubt is an adolescent spurt, but it is by no means as large as generally supposed. For partial proof of this statement, refer to the curves presented later in this chapter showing growth curves made from consecutive measurements of the same children.

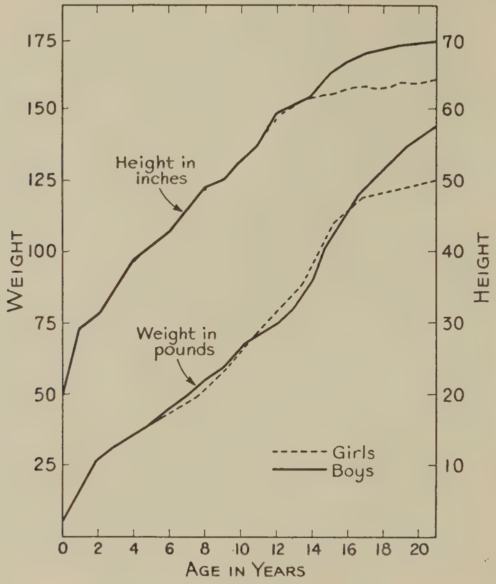
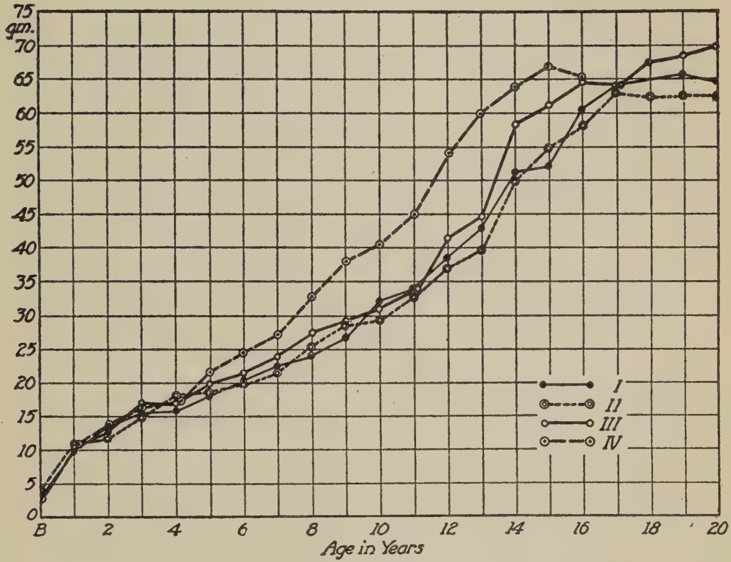


Fig. 14.—Curves Showing Height and Weight Growth for Boys and Girls.

Of course, it must be remembered that any series of measurements constructed by averaging different scores presents a mean growth curve and not the growth that you would find in any individual. Such averages always smooth out the data. Any one person would, from year to year, show irregularities in his growth not present in the mean growth curve. The curve presented above represents the values around which any average individual might be expected to fluctuate. A more satisfactory method of determining growth curves is to measure the same children from birth to maturity. Since such a method of study would take several years, only a few studies of this kind have been made. Scammon[3] presents measurements of the heights of four brothers from birth to age twenty, and Baldwin[4] presents averages of about sixty children who were each measured annually from age six to age seventeen.



*After Scammon*

**Fig. 15.**—Curves Illustrating the Growth in Weight, from Birth to Early Maturity, of Four Brothers. (Annual measurements are indicated by dots; birth orders, by Roman numerals. Based on Guttmann's observations. Reproduced by permission of the publishers from Harris, J. A., Jackson, C. M., Paterson, D. G., and Scammon, R. E., *The Measurement of Man,* Minneapolis, Minnesota, University of Minnesota Press, 1930, p. 183.)

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[3] Scammon, *op. cit.,* p. 177.

[4] Baldwin, B. T., "Physical Growth of School Children," *Iowa Studies in Child Welfare,* Vol. I (1921).

A critical examination of all these results indicates that, for the first year or two after birth, growth is very rapid. After this period, the rate of growth slows down, maintaining a very constant increment from year to year up to the age of fourteen or fifteen. After that, the rate of growth decreases until maturity. Men reach maturity at a later age and a higher measure in both height and weight than women. Height and weight curves for men and women are very similar, with somewhat greater variation in weight than in height.

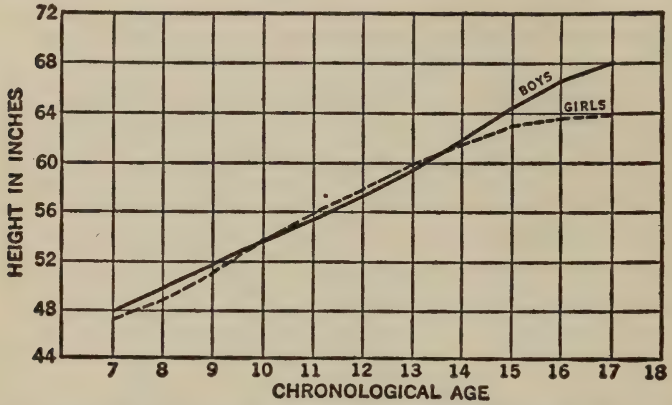


Fig. 16.—Graph Showing Growth in Height of Boys and Girls. (Based on annual remeasurements of approximately 60 boys and girls.)

## Variations in Growth of Parts of the Body

In Figure 17 it is shown that different tissues and parts of the body develop at different rates. Whereas neural tissue develops early and almost reaches its full growth at six years, the genital tissue hardly begins developing before twelve. Lymphoid tissue, such as the thymus gland, develops until about the beginning of the growth of genital tissue at puberty and then actually diminishes in quantity.

Along with this change in tissue growth, there are changes in body shape and form. This is shown in its effect upon the relative lengths of different parts of the body. The head, which at two months of fetal development is half the total length of the body, grows less rapidly thereafter and gradually loses in relative size, until it is only one eighth the total body length at maturity. The legs almost exactly reverse these proportions.

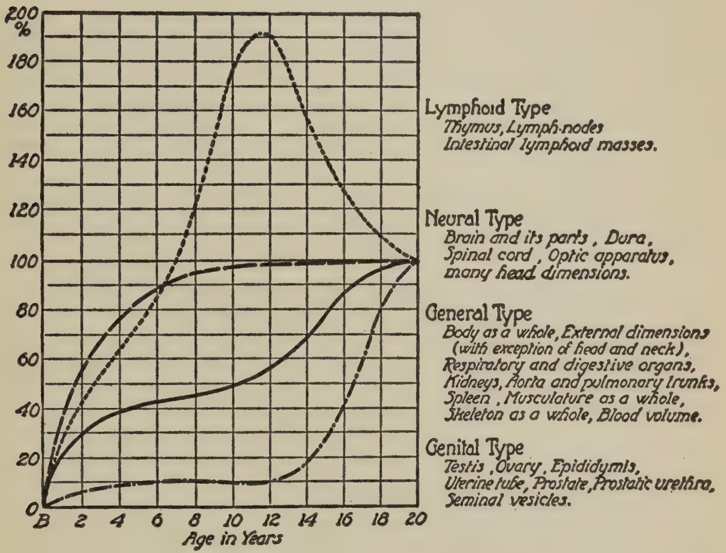


**Fig. 17.**—Graph Showing Major Types of Growth for Various Parts and Organs of the Body.

Baldwin, in his study of growth, made fifteen different measurements for consecutive years from seven to seventeen, using several subjects. One typical growth profile is presented in Figure 18. These curves were constructed with the first measurements at seven years as the base line, and the other measurements for each body part for succeeding years were shown in percentages of the first measurements. For example, the chest strength seems to have increased about 130 per cent the first year and made no additional gain the next year. Some measurements, such as those for strength, vary greatly from year to year—that is, in one year there might be a great gain

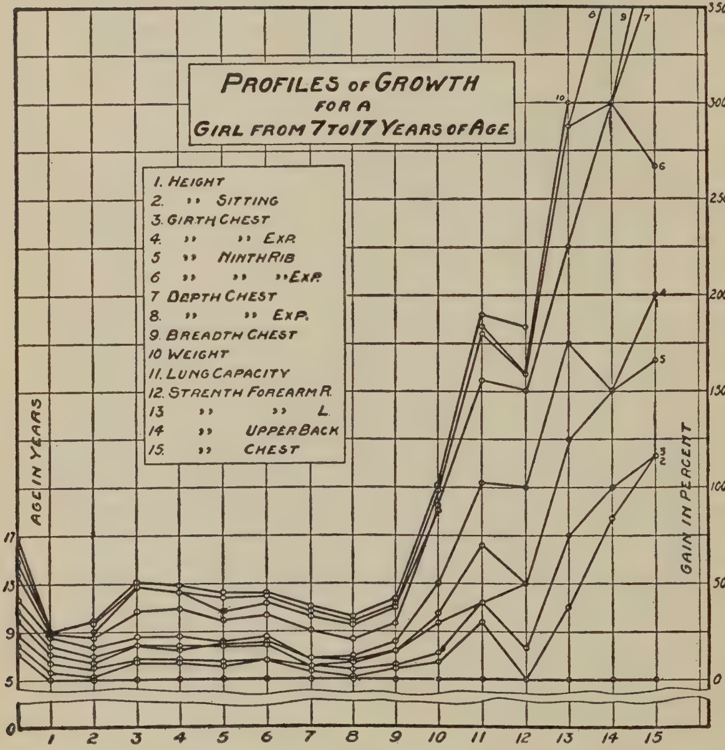


**Fig. 18.**—Annual Growth Curves Showing the Different Rates of Growth for Various Parts and Capacities of the Body. (From the above chart, it can be seen that weight increases rather regularly between ages seven and nine, more rapidly between nine and ten, less rapidly between ten and thirteen, most of all between thirteen and fourteen and very little thereafter.)

and in the next year no gain whatever or even a loss. Other measurements, such as sitting height (No. 2), progressed rather regularly, as shown on the small scale construction of this graph. No doubt some of these variations were due to the unreliability of the measurements. However, common observation confirms the fact that the parts of the body do not all grow at a uniform rate. A child is not just a miniature adult. There are changes which are characteristic of different periods of life, for example, certain changes in body proportions which occur at puberty and gradual line changes in the face which mark the oncoming of old age.

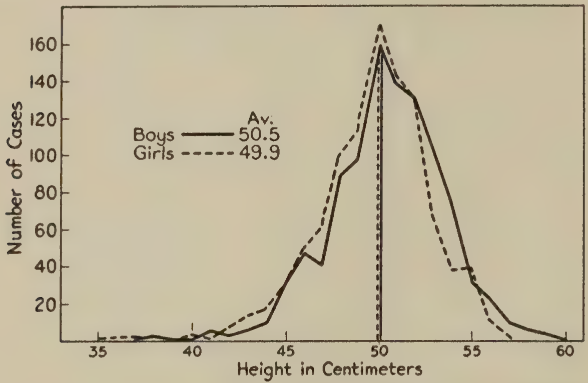
## Physical Differences Among Individuals

In any comprehensive genetic study of the differences between individuals, the discussion should begin with differences between the germ cells which unite to form the individual. The whole basis for inherited differences resides in the egg and the sperm from the parents. Since these cells are not susceptible to study in the case of any individual, all that one can ever do is to discuss the theoretical possibilities of inherited characteristics. Such a discussion would take us too far afield for consideration here, yet we must not lose sight of the fact that the two germ cells contain all the possibilities for inherited traits.

There is also the problem of differences in prenatal development that would be of special interest to the student of biology and of some theoretical interest to all. However, this problem must be left to the embryologist, although it may be said in passing that individual differences in prenatal development are less apparent than in postnatal growth.

**Physical differences at birth.** Several important studies have been made of physical differences at birth.

One of the most reliable and comprehensive of these studies (Table IV) reported in this country was made by Montague and Hollingworth.[5] They examined the records of 1,000 males and 1,000 females selected in the order of birth in the New York Infirmary for Women and Children. The results are presented in Figures 19a and 19b. The average height was 19.9 M.D. 1.1 inches for boys and 19.5 M.D. 1.0 inches for girls; the average weight, 7.4 M.D. .9 for boys and 7.1 M.D. .9 pounds for girls. These records are very similar to more than 1,100 records reported by Holt[6] and 2,000 reported by Karl Pearson[7] in England, and may therefore be considered as very reliable norms for height and weight at birth.



*After Montague and Hollingworth*

**Fig. 19a.—Height in Centimeters of 1,000 Boys and 1,000 Girls at Birth.**

One fact brought out by this study is the small variation among infants. Of the 2,000 children measured, the

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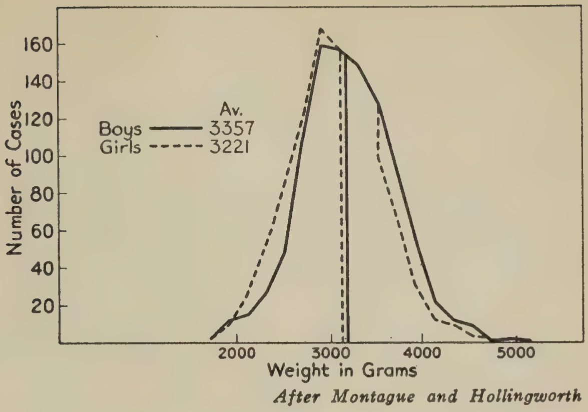
[5] Montague, H., and Hollingworth, L., "The Comparative Variability of the Sexes at Birth," *American Journal of Sociology,* Vol. XX (1914), pp. 335–370.

[6] Holt, L. E., *The Diseases of Infancy and Childhood,* New York, Appleton-Century, 1920.

[7] Pearson, Karl, *Chances of Death,* London, Arnold, 1897.



*After Montague and Hollingworth*

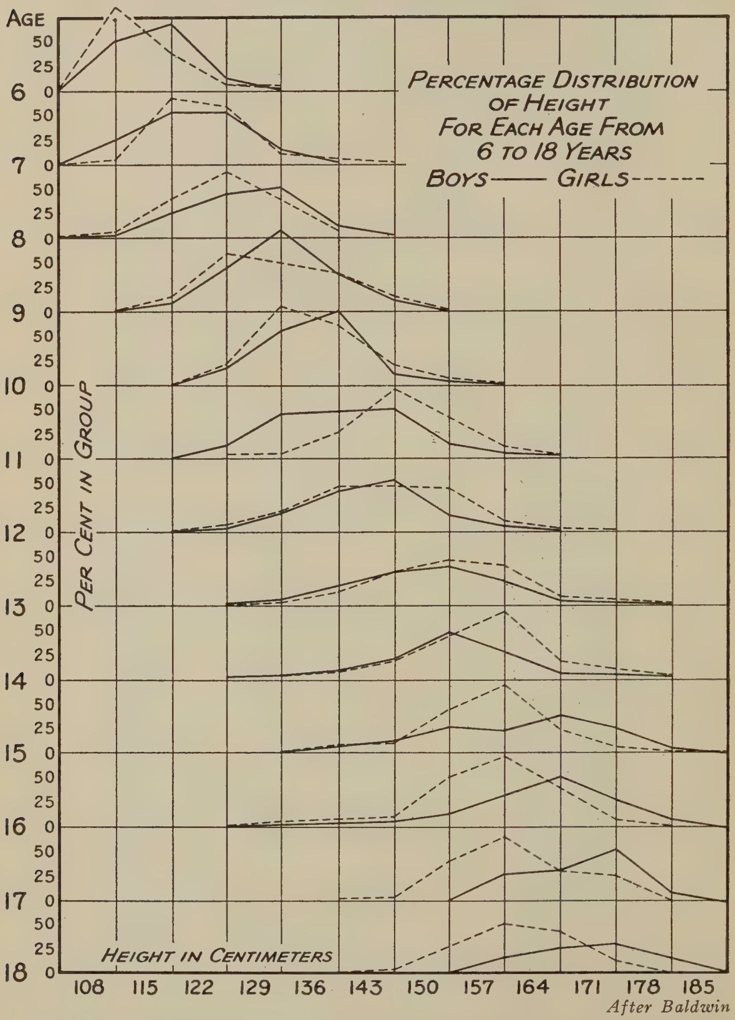
**Fig. 19b.**—Weight in Grams of 1,000 Boys and 1,000 Girls at Birth.

TABLE IV

WEIGHTS OF 2,000 NEWBORN INFANTS

| *Weight in Grams* | *Males* | *Females* |
|---|---|---|
| 1800–1999 | 0 | 1 |
| 2000–2199 | 11 | 9 |
| 2200–2399 | 16 | 26 |
| 2400–2599 | 36 | 55 |
| 2600–2799 | 48 | 88 |
| 2800–2999 | 103 | 120 |
| 3000–3199 | 160 | 169 |
| 3200–3399 | 158 | 160 |
| 3400–3599 | 149 | 150 |
| 3600–3799 | 127 | 101 |
| 3800–3999 | 97 | 67 |
| 4000–4199 | 52 | 29 |
| 4200–4399 | 20 | 12 |
| 4400–4599 | 14 | 8 |
| 4600–4799 | 8 | 2 |
| 4800–4999 | 0 | 2 |
| 5000–5199 | 1 | 0 |
| 5200–5399 | 0 | 1 |
| Total | 1,000 | 1,000 |

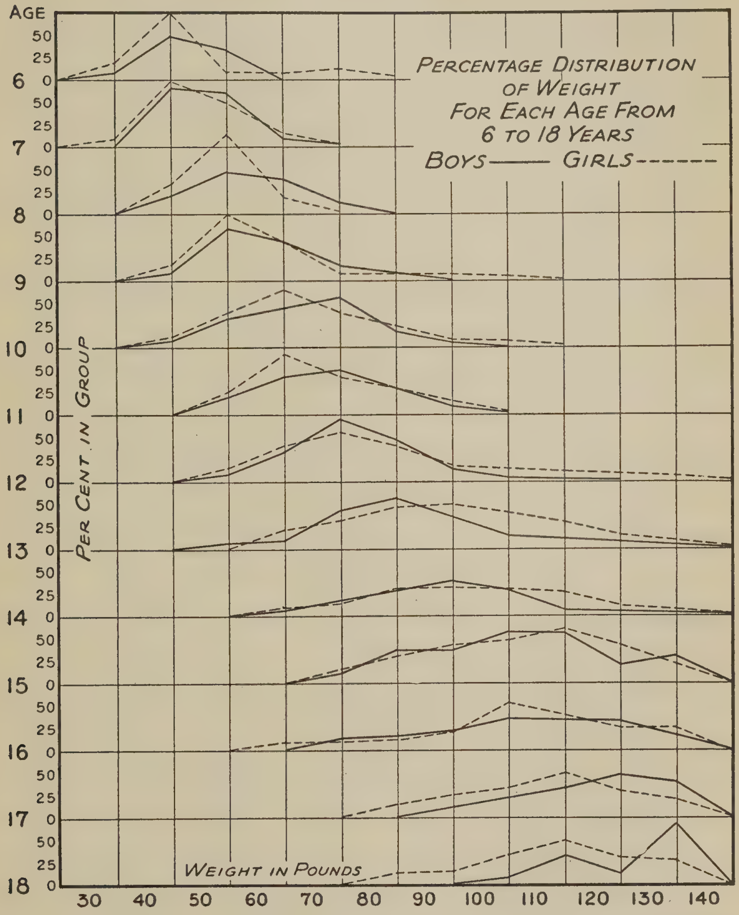
longest child was 24.4 and the shortest 13.8 inches (no premature births were included). The heaviest child weighed 11.6 and the lightest 4.3 pounds. In height, the longest child was less than twice the length of the shortest child, which is less than the difference between the tallest



*After Baldwin*

**Fig. 20a.**—Distributions of Height for 10,560 Children from Ages 6 to 18.

and the shortest adults. We are told[8] that the shortest man on exhibition anywhere is Paul Del Rio, whose height is 19 inches and whose weight is 12 pounds. Then



*After Baldwin*

**Fig. 20b.**—Distributions of Weight for 10,560 Children from Ages 6 to 18.

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[8] See *Life,* Vol. IV (June 20, 1938), pp. 28–29.

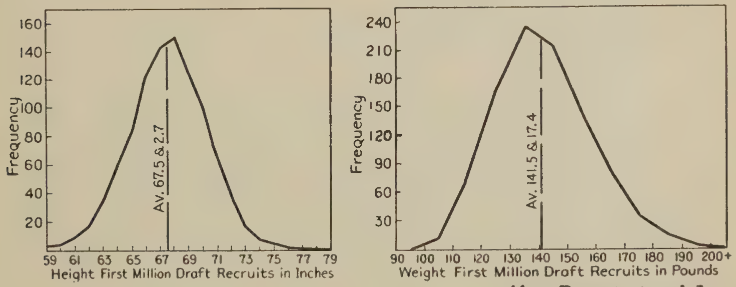
there is Robert Wadlow of Alton, Illinois, who at the age of nineteen was 8 feet 6 inches in height. The one is more than five times taller than the other. Of course, in addition to age variation in height it must be remembered that the tallest and shortest men were selected from a much larger group of people—in fact, they represent practically the extremes of our total population—while the infants were limited to a group of 2,000.

**Growth changes during childhood.** Figures 20a and 20b give distributions for height and weight for 10,560 children from ages six to eighteen. For the most part, the curves conform fairly closely to a normal distribution. There is only a slight increase in the range of the distribution for height in the upper years over that for the earlier years. Characteristically, we expect the variability or scatter of the older to be greater than that of the younger children. In this case the variability in height has not increased very much with age. There is the usual progressive spreading of the curves for weight in the higher ages. These facts are shown statistically by a comparison of the mean deviations for the different ages. The average height in centimeters for age seven for boys is 121.5, and the mean deviation is 6.0; for age seventeen the height is 172.9, with a mean deviation of 5.7; and there are only slight fluctuations for the intermediate ages. For weight in kilograms for ages seven and seventeen these values are 22.9 M.D. 2.8 and 59.1 M.D. 5.4, respectively.

Several studies have been made of the feeble-minded and of superior children, in order to determine the relation between physical form and intelligence. The data from institutions for the feeble-minded are not entirely consistent. In some cases the averages have been as high as for normal children, while in others they have been below normal. Goddard[9] came to the conclusion that defectives are heavier at birth than normals, the principal difference being that defectives cease growing earlier. As adults, they weigh less than other people. On the other hand Terman,[10] in his study of 1,000 superior children with I.Q.'s above 130, found them consistently taller and heavier than children of average ability, but the difference was not great. The superior children also had "broad shoulders and hips, strong muscles and well developed lungs."

The general conclusion from these studies is that there is a slight positive correlation of both height and weight with mental ability, but that the correlation is so low that it is practically valueless and certainly of no significance in predicting the mental capacity in any single case.

**Physical differences among adults.** Figure 21, constructed from data by Davenport and Love, gives height and weight distributions for the first million draft re-



*After Davenport and Love*

**Fig. 21.**—Height and Weight Distributions of the First Million Draft Recruits During the World War.

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[9] Goddard, H. H., "The Height and Weight of Feeble-Minded Children in American Institutions," *Journal of Mental and Nervous Diseases,* Vol. XXXIX (1912), pp. 217–235.

[10] Terman, L. M., *Genetic Studies of Genius,* Vol. I, Palo Alto, California, Stanford University Press, 1925.

cruits during the World War. The average height for men is given as 67.5 inches S.D. 2.7 and the average weight as 141.5 pounds S.D. 17.4. Pearson[11] reports a study of 1,079 men and their wives, with height measurements for each sex (Table V).

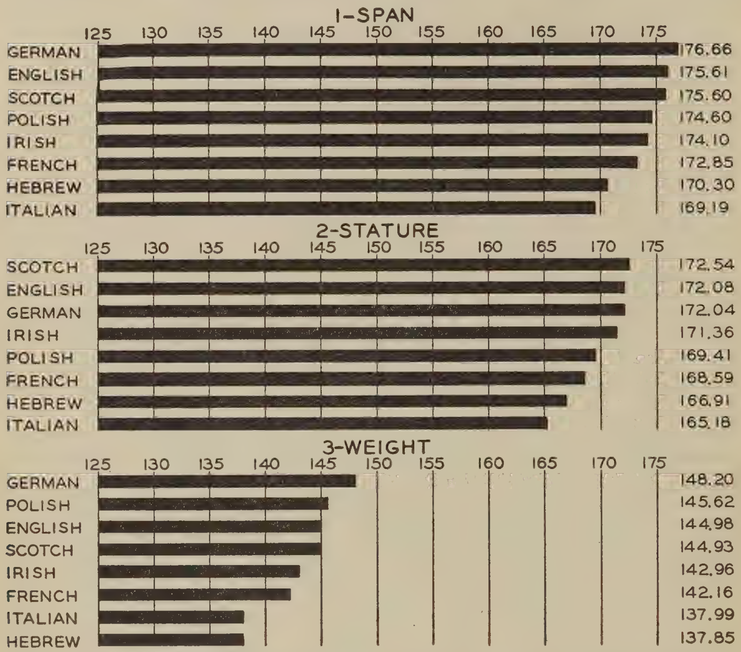

**Fig. 22.**—Average Span, Stature, and Weight for Eight Racial Groups in the United States Army at Demobilization in 1919. (Measurements for span and stature given in centimeters; for weight, in pounds. Reproduced by permission of the publisher from Davenport, C.B., and Love, A.G., *Army Anthropology,* Vol. XV, Pt. I, Washington, D. C., Government Printing Office, 1921.)

The median height for men is 67.7 inches and for women 62.5 inches. These results are in general agreement with other studies, which have given women's height as about 5 inches shorter than men's and their weight as about 25 pounds lighter.

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[11] Pearson, Karl, and Lee, Alice, "On the Laws of Inheritance in Man," *Biometrica,* Vol. II (1903), pp. 357–462.

There are some rather significant differences in height and weight for different parts of the country and for different nationalities. Figure 22 gives the height and weight for eight nationalities as they were demobilized from the United States Army. The Germans were tallest and heaviest, and the Italians and Jews were shortest. There was a difference in averages of 4 inches in height and

TABLE V

HEIGHTS OF 1,079 BRITISH HUSBANDS AND WIVES

| *Height in Inches* | *Frequency of Men* | *Frequency of Women* |
|---|---|---|
| 52 | | 1.5 |
| 53 | | .5* |
| 54 | | 1.0 |
| 55 | | 2.5 |
| 56 | | 6.5 |
| 57 | | 18.5 |
| 58 | .5* | 34.5 |
| 59 | 2.5 | 82.0 |
| 60 | 4.5 | 138.5 |
| 61 | 9.5 | 162.5 |
| 62 | 33.0 | 184.0 |
| 63 | 43.0 | 162.5 |
| 64 | 75.5 | 129.5 |
| 65 | 123.5 | 80.0 |
| 66 | 146.5 | 44.0 |
| 67 | 140.5 | 17.0 |
| 68 | 162.5 | 8.0 |
| 69 | 124.0 | 4.5 |
| 70 | 102.5 | 1.5 |
| 71 | 57.0 | |
| 72 | 34.0 | |
| 73 | 12.5 | |
| 74 | 5.0 | |
| 75 | 2.5 | |

* The presence of .5 frequencies in this table is apparently due to the fact that these data were collected to the nearest one fourth inch and later grouped into one-inch intervals. Measurements falling on the boundary of an interval were divided between the two adjacent intervals.

10.4 pounds in weight. Of course, as represented in the American army, these groups may not have been characteristic of the same nationalities in their home country, but they are representative of these nationalities as they are found in this country.

Several extensive studies have been made of the height and weight of college students. The median measures in Tables VI and VII, taken from various sources,[12] are typical:

TABLE VI

HEIGHT AND WEIGHT OF COLLEGE MEN

| *College* | *Number Tested* | *Height in Inches* | *Weight in Pounds* |
|---|---|---|---|
| Amherst | | 67.9 | 134.6 |
| Cornell | | 67.9 | 134.5 |
| Harvard | 1,000 | 67.9 | 143.0 |
| Northwestern | 853 | 67.9 | 145.4 |
| Stanford | 800 | 69.3 | 151.0 |
| Wisconsin | 1,238 | 67.9 | 139.0 |
| Yale | 2,200 | 67.9 | 138.9 |

TABLE VII

HEIGHT AND WEIGHT OF COLLEGE WOMEN

| *College* | *Number Tested* | *Height in Inches* | *Weight in Pounds* |
|---|---|---|---|
| Oberlin | 1,600 | 62.6 | 112.4 |
| Nebraska | 1,500 | 63.4 | 113.6 |
| Wellesley | 1,500 | 63.2 | 119.4 |

These data show surprising uniformity for different institutions. The norms are very close to height and weight norms for the total population. College students, however, are usually measured as freshmen and sophomores, and at that time have not yet reached full physical maturity. It is therefore likely, and the data available on this subject indicate, that as a group college students are slightly above the average of the general population in height and weight. As has been stated several times, there is some slight positive correlation between stature and ability, and those individuals of the higher grades of intelligence measure above the average in most physical traits.

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[12] For some of these measurements, see Jackson, C. M., *et al.*, *The Measurement of Man,* Minneapolis, University of Minnesota Press, 1930, p. 106.

The chapter might well include other physical measurements, physical defects, and health records. Interesting as these might be, they are less related to the more purely psychological makeup of the individual than those already discussed, and for this reason they will not be included here.

## The Relationship Between Physical and Mental Characteristics

Thus far in this chapter we have discussed differences in physical characteristics without special reference to mental differences. As has already been mentioned, there is the important question of the relationship between physical traits and mental traits.

There are many popular notions about the significance of physical traits in indicating mental traits. Many people believe that mental traits can be inferred from certain physical signs. Some of the common signs which have been used for estimating mental and personality traits are: body size and shape; shape of or "bumps" on the head; outline of the face; eye and skin color; lines in the hand; as well as some other less definitely physiological characteristics, such as handwriting and voice.

Similar methods of judging intellectual qualities from external events have come down to us at least as far back as early Babylonian times. These ancient peoples read men's fortunes from the stars in much the same way as they predicted the seasons. Such methods of reading character have been amplified and others, such as phrenology and physiognomy, have been added. These methods have been passed along from generation to generation without loss of prestige or influence. That such methods are still very much in vogue is well indicated by the statement of one popular writer[13] that $25,000,000 annually cross the palms of clairvoyants in the city of New York alone. This is not the place for an extended discussion of such practices, but needless to say, psychologists are in general skeptical about the value of most of these short-cut methods.

Many of the earlier pseudoscientific methods of attempting to determine mental traits from physical traits may be traced back to the work of Gall and Spurtzheim, about the middle of the eighteenth century. Some of the facts concerning the functions of different parts of the brain had just been discovered, and it was with such information that these two men tried to predict human traits from the shape of the brain. If different mental functions are localized in different parts of the brain, and if the strength of any mental function is proportional to the size of the brain area for that function, then such predictions should be possible.

However, we now know that while there are brain areas for certain mental functions, these areas are projection areas for sensory capacities, motor functions, and the like, and not, as Gall and Spurtzheim and their followers believed, centers for such faculties as "amativeness," mathematical ability, and intelligence. Another defect in this hypothesis is the fact that there is only a very small relation between the size of any brain area and its capacity to function. Not only is this true for parts of the brain but also for the brain as a whole. For example, there is practically no correlation between brain

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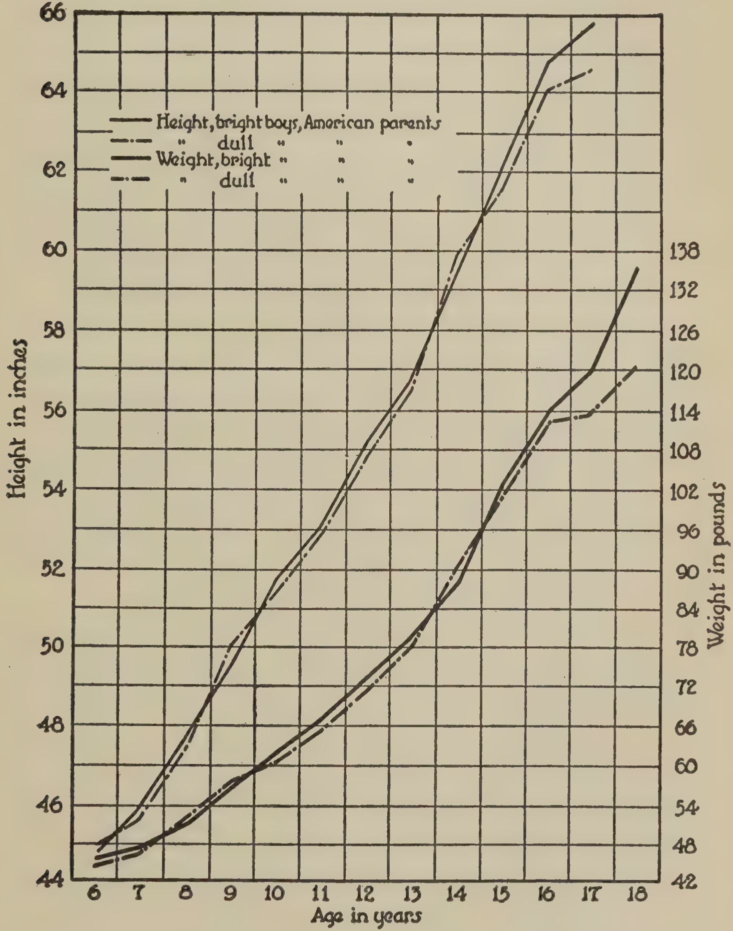
[13] Hoke, Travis, "The Heyday of the Fortune Teller," *Harpers,* Vol. XLVI (1932), pp. 164–236.



*After MacDonald*

**Fig. 23.**—Average Growth Curves (Height and Weight) for Bright and Dull Boys.

size and intelligence. Generally speaking, people who have average-sized heads are more likely to have high ability than those with very large or very small heads. Suffice it to say that the studies of Cleeton and Knight,[14] as well as those of Hull[15] and his students, have failed to find any significant correlations between head size or contour and mental traits.

In addition to the popular belief that mental traits can be predicted by head size or protuberances, there has been considerable scientific interest in the proportion of head width to head length (cephalic index) as a possible indication of mental traits. Pearson[16] compared head measurements of over 2,000 Cambridge University students and more than 4,000 twelve-year-old children with ratings of their intellectual ability. For length of head these correlations ranged from .08 to .14, and for width of head from .10 to .11. Other later investigations have tended to support Pearson's findings, showing that there is a small positive correlation between certain head measurements and intelligence. But such relationships are too small to be of any value in predicting the intelligence of any individual from his head measurements.

One of the early investigations of the relation between body shape and ability was made by MacDonald.[17] He measured the height and weight of 16,473 white and 5,457 colored children in the Washington, D. C. schools.

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[14] Cleeton, G. U., and Knight, F. B., "Validity of Character Judgments Based on External Criteria," *Journal of Applied Psychology,* Vol. VIII (1924), pp. 215–229.

[15] Hull, C. L., *Aptitude Testing,* Yonkers, New York, World Book Company, 1928.

[16] Pearson, Karl, "Relationship of Intelligence to Size and Shape of Head and other Mental and Physical Characteristics," *Biometrica,* Vol. V (1906), pp. 105–146.

[17] MacDonald, Arthur, *Experimental Study of Children,* Ch. XXI, report of United States Commissioner of Education, Government Printing Office, 1897–1898, pp. 985–1204.

These children were grouped in three classes on the basis of their school records, as bright, average, and dull. The foregoing figure gives height and weight curves for the bright and dull pupils from the age of six to eighteen. This study shows only a slight difference between the bright and the dull pupils in height and weight. There is a very slight advantage in favor of the bright group.

Baldwin and his students[18] have made several comparisons of height and weight of school children with their mentality. Baldwin generally obtained rather high correlations, but Paterson[19] criticizes Baldwin's work, showing that in many cases the correlations may well have been due to unreliable measures of mental ability. In the only measurements where Binet tests were used, only 49 people were tested. The large probable errors for such a small number of cases made the method of partial correlation practically useless as a method of eliminating the effect of age differences on Baldwin's correlations. More recently Murdock and Sullivan[20] correlated the height and weight of 600 school children with I.Q.'s. These investigators obtained the following correlations:

$r$ between weight and I.Q. $= .16 \pm .03$
$r$ between height and I.Q. $= .14 \pm .03$

These probably represent typical correlations when age is ruled out as it is when the I.Q. rather than mental age is used.

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[18] Baldwin, B. T., and Stecher, L. I., "Mental Growth Curve of Normal and Superior Children," *University of Iowa Studies on Child Welfare,* Vol. III, No. 1 (1922), pp. 56–58.

[19] Paterson, D. G., *Physique and Intellect,* New York, Appleton-Century, 1930, Ch. II.

[20] Murdock, K., and Sullivan, L. R., "A Contribution to the Study of Mental and Physical Measurements in Normal Children," *American Physical Education Review,* Vol. XXVIII (1923), pp. 209–215, 276–280, and 328–330.

Terman[21] correlated both the height and weight of 397 gifted children with their mental ages. He eliminated differences due to age by classifying the children according to chronological age. Sixteen correlations were calculated, ranging between —.20 and +.44, with the average at about .15.

As a complement to Terman's study, Mrs. Woolley[22] found that children who withdrew from the Cincinnati schools were inferior to those who remained in school, both in scholarship and in physical measurements. At age fourteen only one fifth of the boys and two fifths of the girls who withdrew were equal or superior in physical tests to those who remained in school.

Several types of physiological growth have been compared with intelligence. Baldwin and Stecher[23] made X-ray photographs of the carpal bones of the wrists of children and correlated the ossification with their mental age. They obtained a correlation of .83. Baldwin placed considerable emphasis on this relationship; but when the chronological age was held constant, this correlation dropped to .09. Other later workers[24] have clearly shown that there is very little relation between ossification of bones and mental age of children of the same chronological age.

Ages of dentition and pubescence give similarly low correlations with intelligence. However, physical defects tend to be somewhat more numerous in children of very low intelligence than in those of high intelligence. The gifted children of Terman's study had had fewer diseases of childhood, had missed fewer days from school, and were in better health than his control group of children of average intelligence. There are two possible explanations for this fact: either the superior child inherently tends to be more healthy or it observes better health programs than do children from average homes.

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[21] Terman, L. M., *Genetic Studies of Genius,* Vol. I, Palo Alto, California, Stanford University Press, 1925, p. 168.

[22] Woolley, H. T., *An Experimental Study of Children at Work and in School Between the Ages of Fourteen and Eighteen Years,* New York, Macmillan, 1926.

[23] Baldwin and Stecher, *op. cit.*

[24] Freeman, F. N., and Carter, T. M., "A New Measure of Carpal Bones and Its Relationship to Physical and Mental Development," *Journal of Educational Psychology,* Vol. XV (1924), pp. 257-270.

Many of the earlier studies seemed to find definite positive correlations between physical defects and mental defects. Ayres,[25] for example, found that when he divided nearly 3,500 school children into dull, normal, and bright groups, on the average 23 2/7 per cent of the dull group, 18 3/7 per cent of the normal group, and 15 2/7 per cent of the bright group suffered from one or more diseases, such as diseased glands, defective breathing, bad teeth, enlarged tonsils, adenoids, and so forth. Other early investigations obtained similar results. However, these studies are subject to the criticism that age factors and social status were generally not partialed out. As a rule, the dull children were older and came from inferior social groups. It may well be that lower mental status was associated with age and racial differences rather than with disease.

When age differences and social status are eliminated, the presence of adenoids, diseased tonsils, decayed teeth, and the like seems to have little relation to intelligence. In contrast to these diseases, however, certain others do seem to affect mental status. Hinton [26] recently obtained a correlation of .70 between relatively minor thyroid deficiencies, as measured by basal metabolism, and I.Q.'s of children under ten years of age. Whether further studies will continue to give such high correlations remains to be determined. Most of the other studies with older children and adults have shown low correlations between basal metabolism rate and intelligence. In reviewing studies of physical condition and mental efficiency, Paterson[27] says:

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[25] Ayres, L. P., *Laggards in Our Schools,* New York, Russell Sage Foundation, 1909.

[26] Hinton, Ralph, *The Role of the Basal Metabolic Rate in the Intelligence of Children,* Ph.D. thesis, Northwestern University Library.

> We may briefly summarize this chapter by concluding that on the basis of available evidence the notions that dire mental consequences arise from physical defects and poor physical condition have been and still are greatly exaggerated. Such consequences as exist are demonstrable for mankind in the mass only to a slight degree.
>
> With the exception of diseases and injuries directly involving the central nervous system itself, it would appear that we cannot explain the tremendous range of individual differences in intellect on the hypothesis that unfavorable physical condition or specific physical defects are operative as a major causal factor. Apparently, nature has so safeguarded the central nervous system as to render normal mental development relatively secure or at least strongly immune to such deleterious influences as malnutrition, diseased tonsils, enlarged adenoids, defective breathing, defective teeth, simple goiter, intestinal toxemia, and even hookworm. This, the present verdict of science, does not preclude, of course, the possibility that more sensitive mental measuring instruments may some day reveal the existence of important relationships not now apparent. Finally, our present negative evidence must not be construed as justifying any diminution in the expenditure of thought, money, effort, and technical skill in vigorously pushing forward every sound proposal for improving the physical condition and health of mankind. Surely the maintenance of physical fitness is an end in itself and need not be called upon to justify itself in terms of mental improvement wherever and whenever gains in physical efficiency and well being are demonstrable.

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[27] Paterson, *op. cit.*, pp. 211–212.

Other workers analyzing the evidence might not discount the effect of certain diseases such as hookworm, infantile paralysis, encephalitis, and glandular diseases on mental status as much as Paterson does. Nevertheless, most careful investigators agree that physical defect is too often given as an excuse for mental defect, when the real cause or causes should be sought elsewhere.

### Exercises

1. Distinguish carefully between age differences in physical traits within an individual and individual differences in physical traits among people of a given age.

2. For what reasons would a student of the psychology of individual differences consider the question of physical differences?

3. What suggestions, if any, concerning mental growth do you get from Scammon's four types of postnatal growth curves (see Figure 17)?

4. Show how the availability of children of different ages may affect the form of the growth curve when using the mass, or cross-section, method of studying growth. Suggest some possible differences in representativeness of available: (*a*) five- and seven-year-olds; and (*b*) eight- and fourteen-year-olds.

5. Suggest advantages and disadvantages of the mass, or cross-section, method of studying growth as compared with the other general method of repeated tests, the longitudinal method.

6. Using data from Figure 18, construct a line graph illustrating the changes in height, weight, and strength of the right forearm. Let the $x$-axis represent age and the $y$-axis gain in percentage.

7. Upon examining the data in Table IV, from Montague and Hollingworth, it will be seen that the lightest as well as the heaviest child was a girl. Which sex group is here the more variable? Comment upon the use of the range as a measure of variability.

8. Would you expect the range in height of a random sampling of 2,000 babies to be invariably less than a random sampling of 2,000,000 babies? What general relation would you expect to exist between the range and the size of the sampling?

9. Referring to the data of Baldwin, are we to believe that the height and weight of boys between the ages of seven and seventeen

increase or decrease in: (*a*) absolute variability; and (*b*) relative variability?

10. Compare the individual differences in height among men with the average difference in height between men and women.

11. Comment upon the fact that the median height of the men of six or seven colleges was 67.9 inches (see Table VI). If these data were to be collected again, would you expect them still to be alike?

12. What are the false assumptions of phrenology?

13. In a study made by Porter at the end of the nineteenth century, a group of over 2,000 boys of the *same age* was investigated. It was found that the boys were in the first to fifth grades and that the average weight for each grade group was 55.87, 57.64, 59.66; 61.75, and 65.00 pounds, respectively. How can the correlation between grade placement and weight be as low as +.06? What do you suppose was the variability of each grade group? What would have been the correlation if the variability of the grade groups had been much less?

14. Offer explanations for the positive, though low, correlations which are usually found for children between such physical characteristics as height and weight with mental test scores.

15. What correlation would you expect between mental age and height among (*a*) grammar-school boys; and (*b*) twelve-year-old-boys?

16. Why do the values of *r* found by Terman in his study of the relation between mental age and height and weight for eight groups of boys and girls show such fluctuations (see page 124)?

17. Name two methods of eliminating the effects of the age factor in studies of the relation of physique and intellect among school children.

18. What are some of the ways in which social status can be invoked as a means of explaining the low positive correlation between mental ability and such physical characteristics as height and weight?

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## CHAPTER V

# Sex Differences

Novelists have long had much to say about the characteristic differences between the sexes. Even before the day of the novel, writers were wont to discuss this topic. In recent times, sociologists and psychologists have been much concerned over the problem. Most studies in which both sexes were used for subjects have classified the results according to sex. However, out of the welter of all these discussions relatively few important differences, except those of a strictly physical nature, have been proved to exist.

In this chapter we shall summarize some of the popular opinions on this subject, as well as some of the differences that have been discovered by means of experimental studies. Before going into this discussion, however, we should point out that many of the so-called "sex differences" must be due to the differential treatment given to boys and girls by their elders, and that other differences may be due to inheritance. The fact that girls are trained in a somewhat different way from boys, because the place which will later be taken by them in a family is different, must be at least a partial explanation for differences in their attitudes and behavior habits. In other words, differences between men and women are not of necessity directly due to genetic determiners which they have inherited, along with the determiners for sex, from their parents. If such inherited differences in psychological traits are found, they will be called true sex differences, while other sex differences will be considered only as incidental to the fact of sex.

### Popular Notions About Sex Differences

Unfortunately, the validity of many of the popular notions about sex has not been checked, and some of the experimental studies have shown differences which in many cases have not been checked for their statistical significance. The listing of popular opinions here is therefore not evidence that they are to be accepted as significant sex differences. Furthermore, there has been no attempt to make a thorough survey of these opinions. This listing is to be taken rather as a sample of some of the opinions that have been or are rather widely accepted by the general public.

One such opinion is that women have the power of intuition, whereby they are able to make successful judgments without knowing how or upon what basis these judgments are made. Right is intuitively discriminated from wrong and good from bad, and other kinds of decisions as well are made in this manner. Even husbands are sometimes selected by intuition methods. That successful decisions are sometimes reached on the basis of "hunches" is not to be denied. For many of the important decisions in life, there is not an adequate basis of fact, and guesses must be made. Some people seem very successful in making such guesses and others very poor. But no one should make decisions on these grounds if there be evidence available. If there is not sufficient evidence, then we must do the best we can. Whether women make such intuitive judgments more often or whether they are more successful in doing so than men we do not know.

The fickleness of women is another topic that is often the subject of popular discussion. A woman is supposed to possess the privilege of changing her mind whenever she wishes. This she often does. In contrast to woman's fickleness, man is supposed to possess a strength and sturdiness of character which is often looked upon as a virtue, irrespective of which side of any issue he accepts. It is one of those doubtful virtues which is difficult to distinguish from stubbornness. Whether men and women possess these characteristics in different degrees we do not know. There is so much variation between members of the same sex that any significant difference between the sexes seems unlikely.

Some other popular beliefs concerning differences between the sexes are that women are more emotional than men, that they have weaker sex impulses, and that they talk much more. While we have no experimental evidence on the relative amount of conversation among the sexes, there have been several studies comparing the subjects of conversation. Moore[1] stood on a corner of Broadway, New York City, and collected bits of conversation of the evening theater crowds. When men were talking to men, almost two thirds of them discussed business, money, or amusements. When women were talking to women, only three per cent of their conversation was about these topics, over two thirds of it relating to men, the home, and clothes. In mixed groups the women adapted their conversations to topics of interest to men about twice as often as the men were heard to discuss with women subjects of interest to women.

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[1] Moore, H. T., "Further Data Concerning Sex Differences, "*Journal of Abnormal and Social Psychology,* Vol. XVII (1922), pp. 210–214.

Another study at Columbus, Ohio,[2] and still another in London[3] have given surprisingly similar results. An interesting difference was the fact that, in mixed groups, Englishmen seemed to adapt their conversations more than did Americans to women's interests. An additional study by Stoke and West,[4] in which the variables of race, age, occupation, social background, and place of conversation were held constant, it was found that sex differences in conversational interest were rather small. From this we judge that some of the differences found in the earlier studies were not entirely attributable to sex. Differences between the men and women of the earlier studies in such things as occupation and social status may have been mistaken for sex differences. The consistent indication in these four studies is a tendency for men to talk somewhat more of things and women somewhat more of persons. Yet it may very well be true that these small consistent differences in subjects of conversation are only incidental to the fact of sex and not at all inseparably bound to sex itself.

### Sex Differences in History

The request to "name ten women of enduring world fame," when presented to the women of college classes, always elicits some interesting replies. The answers usually include Cleopatra, Joan of Arc, Catherine the

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[2] Landis, M. H., and Burtt, H. E., "A Study of Conversations," *Journal of Comparative Psychology,* Vol. IV (1924), pp. 81–89.

[3] Landis, C., "National Differences in Conversations," *Journal of Abnormal and Social Psychology,* Vol. XXI (1927), pp. 354–357.

[4] Stoke, Stuart M., and West, Elmer D., "Sex Differences in Conversational Interests," *Journal of Social Psychology,* Vol. II (1931), pp. 120–126.

Great, Queen Elizabeth, and Madame Curie, ending with three or four living women. At least one or two of them are likely to be modern actresses or movie stars. Eminence, as it has been defined in some psychological studies, is the recognition of achievement, with the implied assumption that high innate ability is essential to it. A list of eminent women offers difficulty because the names of eminent women, especially of former times, are much less numerous than those of eminent men. Is this due to a lack of superior ability among women or to a lack of opportunity to achieve recognition? It is possible that both of these causes have been operative and that opportunity for recognition has varied not only from one age to another but with fields of endeavor.

This difficulty in finding a number of women equal to a list of correspondingly eminent men is not limited to college students. Havelock Ellis,[5] in his study of British genius, listed only 55 women out of a total list of 1,030. Likewise Miss Castle,[6] in her study of eminent women of the world during the last twelve centuries, found a similarly small number of women to be included.

In one respect women are distinctly inferior to men. Women possess much less physical strength than men. This difference increases from birth to adult life. The significance of this difference becomes more apparent in the light of history. Until recently, success in life depended largely upon physical strength. Prowess in battle was the standard by which many men in former times gained eminence. Even royalty often attained greatness through conquest. In domestic pursuits the same facts hold true. It was largely by main strength and skill that game was killed and other kinds of food obtained. Even wives were often obtained by conquest. In social control, physical strength has often been no small factor in success. In all such contests woman, because of her lack of strength, has been placed at a distinct disadvantage. She has had to play the lesser role and do the menial tasks. A further handicap to her success in such fields of endeavor is the fact of her incapacitation at times, owing to childbearing and the other physiological conditions related to sex functions.

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[5] Ellis, Havelock, *A Study of British Genius,* London, Hurst and Blackett, 1904.

[6] Castle, C. S., "A Statistical Study of Eminent Women," *Archives of Psychology,* No. 27 (1913).

In olden times, the field in which the greatest number of women gained eminence was government. There have been some notable women sovereigns. Such names as Cleopatra, Catherine the Great, Victoria, and Elizabeth stand out among a group of lesser prominence. Women have been able to direct political, economic, and even military enterprises successfully. The general custom of hereditary royal succession often placed women in power in the absence of a male heir, and since physical strength was not an essential quality of a ruler, but rather intelligence and knowledge, women were able to hold such positions successfully. In more modern times, women have often engaged in literary pursuits. In Castle's list of eminent women, by far the largest number (38.8 per cent) attained eminence in this field. Here also physical strength is not essential for success, so that women can compete on relatively equal terms with men.

Following the invention of the steam engine, the importance of man power began to wane. This loss in value of man power was greatly increased with the application of gas and electric power to industry, and the invention of numerous labor-saving devices for the factory and the home. These changes have produced varied effects, of which the industrial revolution was but one. Not least among them was the gradual supplanting of hard work by machine work, with the consequent emphasis on skill rather than strength. Another consequence was the freedom of women from the common drudgeries of the home. This freed her for greater social and educational advantages, such as were provided by the high schools and colleges. The opening of our colleges and universities to women and the establishment of women's colleges beginning about 1850 provided an opportunity for expending this greater leisure and freedom. As a result, trained women have gone out into a world in which they are able to compete—a world in which intellect and skill have taken precedence over brawn. The World War hastened this process. A great crisis, the removal of a large group of men from industry and the professions, and the exaltation of work brought women into industry. Women were successful in many fields, including several of the professions, and even after the War they continued and competed successfully with men. Thus women have suddenly come into a position of at least near equality with men.

An explanation for the differences in achievement of men and women of historical times is one problem, while a description of their similarities and differences under modern conditions is quite a different problem. Since the time when physical differences became less significant, there still have existed certain distinctions between the sexes. Some of these differences are manifest at birth and are therefore surely innate. Others develop later in life and are probably partly innate and partly learned.

### Sex Development

Sex is determined in man, as in all higher animals, by chromosomes. As explained in Chapter II, there are twenty-four pairs of chromosomes in man. One of these pairs is known as the sex chromosomes. There are two different kinds of sex chromosomes, X chromosomes and Y chromosomes. When the pair of sex chromosomes is made up of two X chromosomes, the sex of an individual is female. When one of the pair is an X and the other a Y chromosome, the sex is male. That is, the sex chromosomes in the female are composed of an XX pair and in males of an XY pair. In the reduction division before fertilization, the female sex chromosome breaks up into two separate X chromosomes, while the male sex chromosome breaks up into an X and a Y chromosome. As has just been explained, if the X chromosome from the male unites with an X from the female, the union will produce a female. If the Y chromosome from the male unites with an X from the female, the union will produce a male.

While sex is determined from the moment of conception, the first stages of embryonic development show little sex differentiation. However, from the very beginning, two factors influence the evolution of the embryo. (1) The sex of the germ plasm is either male or female, and its influence is definite and fixed from the earliest beginnings of the individual. The somatic or body cells also seem to be either male or female in chromosome content. (2) Through endocrine action, the growing embryo develops its peculiar sex characteristics. That is, if it is a male, the endocrine control causes the development of the male sex organs as well as the other special male sex characteristics. In like manner, if the sex of the embryo is female, then the special female characteristics are developed. Both the primary control of sex through the sex chromosomes and the secondary control through the endocrines continue to exert their influence after birth as well as before. In certain respects this control is further augmented by the changes which occur at puberty. Thus we see that the sexes are differentiated not only in their reproductive capacity but in their whole anatomic and physiological structure as well. The fact must continually be kept in mind that while there are many similarities, nevertheless the two sexes are distinct, and that the sex factors themselves are completely different for the two sexes. These differences will now be traced in some detail as they become apparent at and following birth.[7]

## Sex Differences in Early Life

There is a slight difference in height and weight between boy and girl babies. Mrs. Hollingworth[8] found the average height for boys to be 50.5 centimeters and for girls 49.9 centimeters. The average weight she found to be 33.6 grams for boys and 32.1 grams for girls. Mrs. Hollingworth's study was made in order to test the hypothesis of Havelock Ellis and Thorndike that boys vary more than girls. This hypothesis holds that while the average for the sexes may be about the same, boys deviate on both sides of their average more than girls do on theirs. Mrs. Hollingworth's study shows no greater variability in one sex than in the other. More recent studies have tended to confirm her results.

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[7] For a much more complete account of the genetic differences between the sexes, see Chapter XVI, by Miles, C. C., of Murchison, C. A. (editor), *Handbook of Social Psychology,* Worcester, Massachusetts, Clark University Press, 1935. Also, for a more technical discussion, Allen, E., *Sex and Internal Secretion: A Survey of Recent Research,* Baltimore, Williams and Wilkins, 1932.

[8] Hollingworth, L., and Montague, H., "The Comparative Variability of the Sexes at Birth," *American Journal of Sociology,* Vol. XX (1914–1915), pp. 335–370.

There is some difference between the sexes in the number of births. Textbooks commonly state that 105 boys are born for every 100 girls.[9] An examination of birth statistics of the Census Bureau indicates that younger mothers give birth to a larger excess of boys than do older mothers.[10] The excess of male births of all mothers does not disturb the sex ratio of adult life, because of the greater male mortality.

Mead[11] found that girls walk and talk earlier than boys. Others[12] have substantiated these results and extended this information by showing that girls use their first words more accurately, have a larger vocabulary, and construct better sentences. These differences have often been explained by saying that girls mature more rapidly than boys. This should be accepted only as a partial explanation. We must recognize, as have many investigators, that girls and women may have a slightly higher average ability in language, that they are superior to men in this special ability. The precocious physical development of girls as an explanation for their earlier walking is at least questioned by certain results of studies of motor abilities of children. Studying five-, six- and seven-year-old children, Miss Jenkins[13] found that the boys equaled or excelled the girls of their own age in dashes, ball throwing for distance and accuracy, and ball kicking, and that they were exceeded by the girls only in the speed of hopping. While other surveys of the motor abilities of children have shown boys to be generally superior, we should recognize the possibility that this superiority is due in whole or in part to the greater amount of practice of boys in such skills. Allen,[14] in reviewing the literature of sex differences, expressed the opinion that boys' superiority in motor development is a matter of opportunity to practice rather than inherent sexuality. Several studies of motor learning in young children have shown that girls, while generally inferior to boys in level of proficiency, have made greater gains in acquiring motor skills.[15] Without these special periods of practice, girls

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[9] According to the Bureau of the Census for the years 1915 to 1933 inclusive, the number of male births for each 1,000 female births has been from 1,055 to 1,060, with the modal number of 1,057. The number of stillbirths among males greatly exceeds that for females, being from 1,315 to 1,372 for each 1,000 females. See *Birth, Stillbirth, and Infant Mortality Statistics,* Nineteenth Annual Report of the Bureau of the Census, United States Department of Commerce, 1933 and 1936.

An interesting speculation as to the excess of male births is given by Morgan, in which he suggests that the male-producing spermatozoa, being smaller, are better able to swim in the tubes of the reproductive system of the female and more often reach and fertilize the ova. See Morgan, T. H., *The Physical Basis of Heredity,* Philadelphia, Lippincott, 1919, pp. 199–200.

[10] Using the figures of the Bureau of the Census for 1929 to 1930 inclusive, sex ratios of the children of mothers of varying ages were computed. For each 1,000 daughters it was found that mothers under twenty had 1,057 sons, mothers in the twenties 1,056 sons, mothers in the thirties 1,054 sons, and mothers forty or older 1,043 sons.

[11] Mead, C. D., "The Age of Walking and Talking in Relation to General Intelligence," *Pedagogical Seminary,* Vol. XX, 1913, pp. 460–484.

[12] Terman, L. M., *et al., Genetic Studies of Genius,* Vol. I, Palo Alto, California, Stanford University Press, 1925. Also McCarthy, D., "The Language Development of the Pre-School Child," *University of Minnesota Institute of Child Welfare Monographs,* Series No. 4 (1930).

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[13] Jenkins, Lulu Marie, "Motor Achievement of Children Five to Seven Years of Age," *Columbia University Contributions to Education*, No. 414 (1930).

[14] Allen, C. N., "Recent Research on Sex Differences," *Psychological Bulletin*, Vol. XXXII (1935), pp. 343–354.

[15] Goodenough, F. L., and Brian, C. R., "Certain Factors Underlying the Acquisition of Motor Skill by Pre-School Children," *Journal of Experimental Psychology*, Vol. XII (1929), pp. 127–155. This reports a rope-ring tossing experiment in which twelve girls of kindergarten age gained more during a period of training than did eight boys of similar age.

Hicks, J. A., "The Acquisition of Motor Skill in Young Children," *University of Iowa Studies in Child Welfare*, Vol. IV, No. 5 (June 1, have usually less motor skill and less strength than have boys of the same age, although their more precocious physical development might lead one to expect them to compensate during childhood for their subsequent inferior strength as adults. Studies in which the Minnesota mechanical ability tests were used with both boys and girls indicate that the difference in favor of the boys increases from age to age and is greatest in acts in which the greatest strength and skill are required.

### Physical and Physiological Differences Between the Sexes

Physical and physiological differences between the sexes are important for two reasons. First, the differences are important in themselves as illustrations of significant sex differences. Second, they give clues for the explanation of other sex differences.

In the Chapter IV, on physical growth, curves are presented showing the weight and height norms for each sex. From these curves it is apparent that boys exceed girls and men exceed women in height and weight. There is only one point at which girls exceed boys, and that is at the ages of nine and ten years for height, and at twelve, thirteen, and fourteen for weight. The most significant dif-

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1931), p. 80. This is an extended study of twenty-six boys and thirty-four girls aged three, four, five and six years who, among other things, practiced throwing a ball at a moving target. The sex differences were small compared to the age differences, and the girls gained in skill much more than the boys.

McGinnis, Esther, "The Acquisition and Interference of Motor Habits in Young Children," *Genetic Psychological Monographs,* Vol. VI, No. 3 (1929), pp. 203–311. The experimental group of this study was sixty children, ten boys and ten girls at the ages of three, four and five years. Fifty trials were given on the Young Slot Maze A, a hand maze. The results of initial trials showed marked sex differences which the girls were able practically to overcome by the fiftieth trial.

ferences occur after puberty. Girls cease to grow rapidly in both height and weight after fifteen or sixteen years of age, while boys continue to grow two or three years longer. Young adult males are about twenty-five pounds heavier than females their own age and about four inches taller.[16]

The sexes also differ in physical strength. Beginning with little or no difference at birth, boys gradually surpass girls. These differences become progressively greater until, in adult life, men are on the average about twice as strong as women. This difference is very constant, as shown in Figure 24 for thirty-eight different measurements.

In at least one sensory capacity there is a definite sex difference, which affects a small percentage of the population. About 4 per cent of all men are afflicted with color blindness, while only about one tenth as many women, or less than one half of one per cent, are so afflicted. Although there appear to be many kinds of color blindness, resulting both from disease and inheritance, the most common type is the inherited inability to distinguish red from green. Its greater frequency in men is due to the fact that this type of color blindness is inherited as a sex-linked recessive.[17]

There is a long list of other differences between the sexes that might be enumerated. Chief among these are the ones directly or indirectly related to sex. Some are apparent before puberty, while most of them become

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[16] For a summary of the records of Baldwin, Boas, Crum, Smedley, and others, see Gilliland, A. R., *Genetic Psychology,* New York, Ronald Press, 1933, p. 148.

[17] The inheritance of sex in human beings is determined by one pair of chromosomes, XX for females and XY for males. Either the gene (determiner) for color-blindness, a recessive, or the gene for normal sight, a dominant, is in each X chromosome; but neither is borne by the somewhat smaller Y chromosome. Since the chromosomes of a male are always XY, he will be color-blind if the X chromosome alone

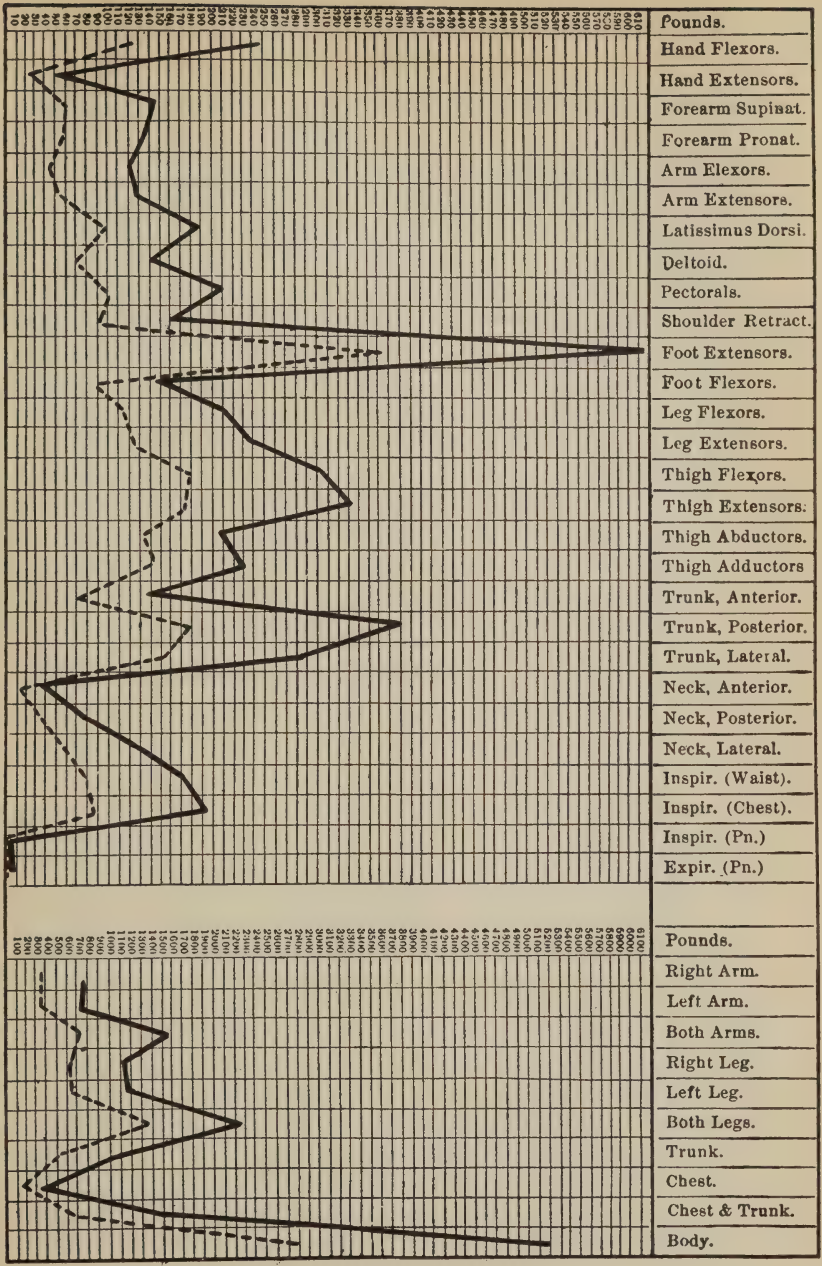

Fig. 24.—Graph Showing Actual Strength of the Principal Groups of Muscles of the Average Man and Woman. (Solid line represents men; dotted line, women.)

accentuated and others first become noticeable at this time. In fact, the age of the onset of puberty is one of these differences. The age of onset for girls is on the average about thirteen years and for the boys about a year later. The onset is earlier for those who live in warmer climates. It is also earlier for those who work out of doors, for the mentally precocious, and for Jewish people. There is a greater differentiation in the sexes at puberty because of the growth of the reproductive functions. Chief of these is the menstrual cycle in women, while another is the change which occurs during pregnancy. These conditions produce both physiological and emotional changes. Together with the rearing of children, they affect the social and economic status of women in their attempts to compete with men.

In addition to the primary sex functions, which become active at puberty, there are a number of secondary sex functions which arise. These are controlled by the hormones from the ductless or endocrine glands. The in-

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bears a determiner for color blindness (the Y can bear no dominant to hide the effect of this recessive), whereas a woman, always having two X chromosomes, would not be color-blind unless each bore a gene for the defect. A color-blind man having of course an affected X chromosome and mated to a normal woman without color-blind ancestry, could have no sons—no XY individuals—who were color-blind, for each would have received from his mother a normal X chromosome and from his father only a Y chromosome, which plays no part in this type of inheritance. The daughters of such a pair, being XX individuals, would in every case inherit an affected X chromosome from their father and a normal X chromosome from their mother. They would be normal-seeing women because of the dominant determiner received from the mother, but, mated with normal men, they would bear sons who in one half of the cases would be color-blind. Thus men who are color-blind and have normal-seeing parents have always received their color blindness through their mother from a grandparent or a more remote maternal ancestor. Likewise a color-blind woman always has a color-blind father and a mother who is either color-blind or of color-blind ancestry. Nearly any book on genetics will have a helpful diagram of this type of inheritance.

terstitial cells of the male develop about the same time as the primary sex functions. The endocrine secretions in the male produce changes in the hair, especially the growth of pubic hair and the beard, and a growth of the vocal apparatus, resulting in the Adam's apple and a change in the pitch of the voice. In the female the endocrine secretions cause certain growth changes, such as the growth of the breasts and the buttocks and the deposition of fat on other parts of the body, producing a more rotund form and slightly reducing the specific gravity of the body. These changes, along with others that occur at this time, are factors which are likely to result in a more sedentary form of life for the girl.

There is a variation in brain weight between the sexes. The average for women is usually given as from 1,200 to 1,250 grams and for men from 1,350 to 1,400 grams. Although men have the larger brain, if the size of their bodies is considered, women's brains are relatively as large or possibly slightly larger than men's.[18]

Women also show some minor differences in body structure. Their thigh bone is shorter, the arm flatter, and the index finger relatively longer than in men. The chest and spinal column of men and women are differently proportioned and many joints are not formed alike. The female heart is said to beat from eight to ten times faster per minute than man's under similar conditions.

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[18] While, in general, little importance can be attached to brain size, it is of interest to note that some serious problems of selection arise for those who would know the exact average difference between the weights of the brains of men and women. Since the brains studied are usually secured from unclaimed bodies, it is likely that the selection of women is somewhat inferior socially and possibly physically to that of men, because women—even in the lower levels of society—are usually more protected by their families than are men.

## Mental Differences Between the Sexes

The data on sensory and perceptual differences between the sexes is not conclusive. In some cases it is one sex and in other cases the opposite sex that excels. Helen Thompson,[19] who made one of the first thorough studies of sex differences, obtained the following results (Table VIII) when she compared the records of twenty-five college men with those of the same number of college women:

TABLE VIII

PERCENTAGE OF MEN REACHING OR EXCEEDING THE MEDIAN FOR WOMEN

| | |
|---|---|
| Reaction time | 68 |
| Threshold of pain | 46 |
| Threshold of taste | 34 |
| Threshold of smell | 43 |
| Lifting weights | 66 |
| Two-point discrimination | 18 |
| Rate of tapping | 81 |
| Card sorting: | |
| Speed | 14 |
| Accuracy | 44 |
| Pitch: | |
| Upper limit | 52 |
| Lower limit | 50 |

However, in comparing 100 boys with the same number of girls, Gilbert[20] found the percentage of boys reaching or exceeding the girls' median in weight discrimination to be 46 per cent for those fourteen years old or younger, while it was 58 per cent for those from fifteen to seventeen years old. In color discrimination, 39 per cent of the boys reached or exceeded the median girl in the younger group and 58 per cent did so in the older group. This and similar studies would seem to indicate few consistent differences between the sexes in sensory discrimination.

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[19] Thompson, Helen, *The Mental Traits of Sex,* Chicago, University of Chicago Press, 1903, p. 188. In expressing differences between the sexes, as was done in this study, it should be noted that percentages at or near fifty indicate no difference, while those above fifty indicate male superiority and those below fifty female superiority.

[20] Gilbert, J. A., "Researches on the Mental and Physical Development of School Children," *Yale Psychological Studies* (1894).

In some types of simple activities, such as tapping and reaction time, men seem to excel. Thompson found that 68 per cent of the men reach the median for women in reaction time and 81 per cent in rate of tapping. Gilbert obtained somewhat similar results. Men have also consistently held speed records in typing. However, in card sorting, Thompson found that women excel. Miss Book[21] attempts to differentiate between these results by saying that boys are superior in rapidity of movements when the attention remains fixed, whereas girls are superior in types of activity when the attention is rapidly shifting. This may or may not be the correct explanation. It seems rather difficult to justify on logical grounds. In fact, no completely satisfactory theory for accounting for many of the smaller sex differences has yet been proposed.

### Sex Differences in Language Ability

It has already been mentioned that, on the average, girls begin to talk sooner than boys. This early superiority in language appears to increase with age. In many informal and formal tests, girls have excelled in reading, language work, and grammar. Yet this is not an invariable result, as shown by the studies of Schiller[22] and Bryan.[23] While most of the great literary geniuses of the world have been men, women are rapidly approaching a position of equality in certain fields of journalism and are distinguishing themselves in lyric poetry and in fiction.

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[21] Book, H. M., "A Psychological Analysis of Sex Differences," *Journal of Social Psychology,* Vol. III (1932), pp. 434–462.

[22] Schiller, Belle, "Verbal, Numerical and Special Abilities of Young Children," *Archives of Psychology,* No. 161 (1934), p. 69. In this study of 395 Jewish children in the third and fourth grades of a New York public school, no reliable sex differences were found in the ability to handle verbal concepts.

In tests of memory, especially of rote memory, girls usually excel. It has been suggested that this may be due to the fact that most memory is in terms of language, and that the same trait which makes for success in one has a similar effect in the other. Tables IX and X, taken from Whipple,[24] represent some earlier careful studies of this question. An examination of these tables will show that the girls are in most cases ahead of the boys. Although nothing in these tables indicates the manner

TABLE IX

Percentage of Correct Memory for Nine-Term Series of Different Kinds

| *Kind of Series* | *Percentage of Correct Scores* | |
|---|---|---|
| | *Boys* | *Girls* |
| Real objects | 82.2 | 91.4 |
| Auditory numbers | 64.8 | 71.8 |
| Sounds | 59.6 | 62.2 |
| Tactical terms | 64.2 | 71.0 |
| Visual terms | 60.6 | 67.2 |
| Auditory terms | 59.4 | 60.2 |
| Emotional terms | 31.2 | 59.4 |
| Foreign terms | 24.0 | 23.8 |

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[23] Bryan, Alice I., "Organization of Memory in Young Children," *Archives of Psychology,* No. 162 (1934), p. 56. A group of 200 children between the ages of five and six, all with school experience but none in the first grade, showed no significant sex differences in the thirteen tests used. The boys were unreliably higher in a vocabulary test and the girls were slightly, though unreliably, higher in nine of the eleven memory tests.

[24] Whipple, G. M., *Manual of Mental and Physical Tests,* Baltimore, Warwick and York, 1915, pp. 553 and 554.

in which the subjects were selected, the fact that studies have frequently shown girls to have an advantage in rote memory is taken as reason to suppose that, as a group, they are a little more gifted in this respect than boys.

The superiority of girls in language and rote memory is paralleled by that of boys in manual skill and mathematics. The superiority of boys in mathematics has generally been found for all ages, especially for older boys, both in number concepts and in mathematical reasoning. It is not easy to account for the difference between language and mathematical abilities in the sexes when we realize that both language and mathematics are fundamentally dependent upon symbolism. There is, of course, the difference that the symbolism of language is

TABLE X

Results of Testing for Memory of Related and Unrelated Words (288 and 270 Tested, Respectively)

| *Age* | *Related Words* | | | | *Unrelated Words* | | | |
|---|---|---|---|---|---|---|---|---|
| | *Boys* | | *Girls* | | *Boys* | | *Girls* | |
| | *Median* | *Probable Error* | *Median* | *Probable Error* | *Median* | *Probable Error* | *Median* | *Probable Error* |
| 8....... | 13.0 | 1.0 | 13.0 | 1.6 | 11.1 | 1.6 | 11.5 | 1.3 |
| 9....... | 14.0 | 2.0 | 14.0 | 1.7 | 12.2 | 1.7 | 12.4 | 1.4 |
| 10....... | 15.0 | 1.7 | 15.3 | 1.9 | 12.2 | 1.7 | 14.4 | 1.4 |
| 11....... | 15.0 | 1.7 | 16.5 | 1.7 | 12.5 | 1.8 | 14.3 | 1.4 |
| 12....... | 16.4 | 1.7 | 16.0 | 1.6 | 12.8 | 1.8 | 14.0 | 1.5 |
| 13....... | 16.5 | 1.8 | 17.0 | 1.5 | 13.5 | 2.1 | 13.5 | 1.5 |
| 14....... | 16.9 | 1.3 | 17.5 | 1.5 | 13.7 | 2.2 | 14.0 | 1.5 |
| 15....... | 16.0 | 1.3 | 17.5 | 1.5 | 13.7 | 2.2 | 14.0 | 1.5 |
| 16....... | 17.0 | 1.3 | 17.8 | 1.5 | 14.0 | 2.2 | 14.5 | 1.5 |
| Adults... | 16.5 | 1.5 | 17.0 | 1.9 | 12.8 | 1.2 | 13.0 | 1.4 |

more concrete than the symbolism of mathematics. But this fact may not be significant in explaining the difference in mathematical and linguistic abilities, for proof is not conclusive that it is a true congenital sex difference. It is likely that a girl's environment directs her interest more often to literary matters. In other school subjects the differences between the sexes are not so apparent, so that some investigators obtain one result, while others obtain opposite results.

In college and high school, men generally do better in the natural sciences. A careful study by Hurd[25] of high-school students matched for age, grade, and instructor showed male superiority in a physical science. The boys showed marked superiority in the preliminary test, and in the final test, after a period of instruction, they were still ahead of the girls. The training period reduced the sex differences but did not eliminate them. Although girls profited more in an absolute way by the period of instruction, they made the same percentage of possible gain as did the boys. In the social sciences, honors are usually divided between the sexes. Since girls in the elementary grades and high school have been found to excel in language, it is not surprising to find that they do the same in college.[26]

It is very doubtful whether inherent differences play as great a part in the respective standings of the two sexes as do interests and opportunities for placement in occupations. Women interested in domestic science or nursing have little more difficulty with courses in chemistry than men who are preparing for medicine or dentistry. Men are often especially motivated for a study of mathematics because of the vocational significance which this subject may have for them.

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[25] Hurd, A. W., "Sex Differences in Achievement in Physical Science," *Journal of Educational Psychology,* Vol. XXV, No. 1 (1934), p. 70.

[26] In 1932, there were but three women in college to every five men. It is very probable that college women are a more highly selected group for scholastic aptitude and language ability than are college men. See *Statistical Abstract of the United States,* Bureau of Foreign and Domestic Commerce, United States Department of Commerce, 1935, p. 118.

## Intellectual and Educational Differences Between the Sexes

Extensive studies have been made by means of intelligence tests of the differences between the sexes. These have included all ages from preschool to college. The first important study of this kind was made by Terman[27] during the standardization of the Stanford Revision of the

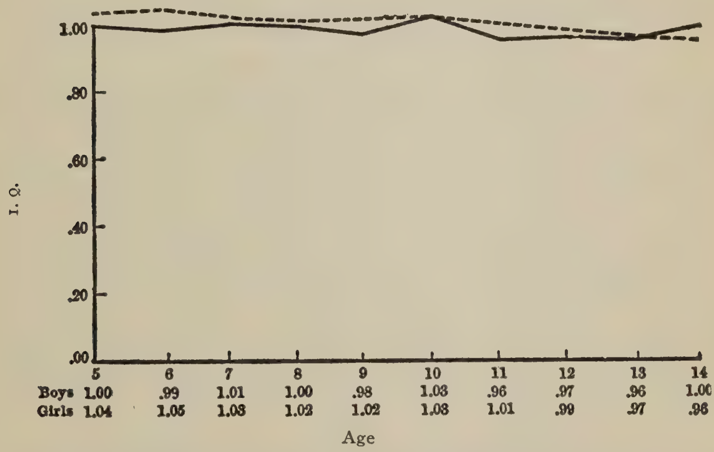

**Fig. 25.**—Median I.Q. of 457 Boys and 448 Girls for Ages 5 to 14. (Unbroken line represents boys, dotted line, girls. Reproduced by permission of the publisher from Terman, L. M., *The Measurement of Intelligence,* Boston, Houghton Mifflin, 1916, p. 69.)

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[27] Terman, L. M., *The Measurement of Intelligence,* Boston, Houghton Mifflin, 1916.

Binet Scale. He used 457 boys and 448 girls. The foregoing graph gives his results in terms of the I.Q. from ages five to fourteen. From this study, it appears that girls have the higher I.Q. before age thirteen, and that for the two upper years the norms are almost the same but with a slight advantage for the boys at age fourteen.

Most of the later studies have used group tests. Table XI gives the results of several of these studies. A casual inspection of these data fails to show a consistent superiority of either sex. There are various causes for the lack of uniformity in these results. Some intelligence tests are more favorable to one sex than the

TABLE XI

Representative Studies of Sex Differences in Intelligence Test Scores

| *Author* | *Test* | *Number Tested* | *Age or Grades Tested* | *Which Sex Excelled* | *Comparison of Scores* |
|---|---|---|---|---|---|
| Baldwin and Stecker | Binet | 105 | Preschool | Girls | Boys' I.Q. 113; girls' I.Q. 117 |
| Book and Meadows | Indiana | 5,925 | High School. | Boys | 56.2% of boys excel median for girls |
| Broom | Binet | 1,200 | High School. | Boys | Boys' I.Q. 104.9; girls' I.Q. 101 |
| Colvin and McPhail | Brown University | 3,333 | High School. | Boys | ............... |
| Commins | Multimental | 12,400 | 9–14 | Girls | ............... |
| Lincoln | Dearborn | 3,422 | 7–16 | Little difference | ............... |
| Pintner | Nonlanguage | 2,270 | .......... | No difference | ............... |
| Pressey | Pressey | 2,544 | High School. | Girls | Girls M.A. about 6 months above boys |
| Terman | Binet | 1,366 | High School and College | Boys | 144 boys to 100 girls with I.Q. over 130 |
| Thorndike | I. E. R. | 33,167 | 13–18 | Boys | Boys 9 points over girls |
| Whipple | Army Alpha | 4,117 | 8–13 | Girls | Girls 7 months ahead of boys |
| Winsor | Army Beta | 2,321 | 10 | Boys in Test II; girls in Test V | ............... |

other. Army Alpha was constructed for use with men who, as a group, almost always make higher scores than women. Other tests, especially those with a large language factor, are generally easier for women. Often there is a difference in the standards of selection of the samples tested. Sometimes the selection is more rigid for one sex and sometimes it is more rigid for the other sex.[28] Again, the differences may be small and due to chance factors. Critical ratios showing the number of chances out of a hundred for which the differences are significant have been computed for relatively few studies. If all disturbing factors could be eliminated, it seems fairly certain that little if any difference would be found in general mental ability between the sexes.

Women generally make better average classroom grades than men both in high school, where selective factors might make this fact unexpected, and in college, where selection would make it the logical result. Table XII shows average grades and average test scores of Freshmen in the College of Liberal Arts at Northwestern University. The fact that the women have slightly higher grades than the men is characteristic of college data in general, but that they have about the same average test scores is less characteristic. Their similarity of test scores is perhaps due to the fact that similar methods of selection were used for both sexes. The fact that more men than women were denied admission is not shown in these data. In the list of the three years shown, the women were consistently higher in scholarship than were the men; the ratio of differences between average grades to the standard

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[28] Although men are more numerous in college than are women, their sex is rather consistently outnumbered in high school. In some of the high-school groups in Table XI, the boys constituted only 40 per cent of the number tested. In such cases the boys, being more highly selected, should be expected to make higher test scores. For interesting comments on this question, see: Paterson, D. G., and Langlie, T. A., "The Influence of Sex on Scholarship Ratings," *Educational Administration and Supervision*, Vol. XII (1926), pp. 458–468.

Figures collected by the United States Department of Commerce for high-school and junior high-school students indicate that in 1930 there were 94 boys to each 100 girls, while in 1925 there were less than 89 per cent as many boys as girls in secondary schools. See *Statistical Abstracts of the United States*, 1937.

TABLE XII

Average Grades and Intelligence Test Scores of Freshmen at Northwestern University

| *Freshman Year* | *Men* | *Women* | $\frac{\textit{Difference}}{\sigma\ \textit{Difference}}$ |
|---|---|---|---|
| 1930–1931: | | | |
| Number | 408 | 303 | .... |
| Grades: | | | |
| Means | 3.10 | 3.55 | 4.15 |
| S.D. | 1.37 | 1.46 | .... |
| Intelligence test scores: | | | |
| Means | 174.8 | 177.7 | 0.83 |
| S.D. | 46.14 | 45.67 | .... |
| 1932–1933: | | | |
| Number | 401 | 299 | .... |
| Grades: | | | |
| Means | 3.37 | 3.71 | 3.1 |
| S.D. | 1.48 | 1.36 | .... |
| Intelligence test scores: | | | |
| Means | 198 | 196.2 | 0.5 |
| S.D. | 52.6 | 46.6 | .... |
| 1934–1935: | | | |
| Number | 375 | 249 | .... |
| Grades: | | | |
| Means | 3.50 | 3.71 | 1.81 |
| S.D. | 1.43 | 1.41 | .... |
| Intelligence test scores: | | | |
| Means | 203.3 | 201.8 | 0.41 |
| S.D. | 47.2 | 41.7 | .... |

error of the difference ranged from 1.81 to 4.15. Other studies[29] have obtained similar results.

Several reasons for the generally higher grades of women may be offered. It appears likely that they attach more importance to grades than do men, for men have many other ways of gaining social recognition. In the competition for grades, women are not handicapped by a lack of size or strength. In general they suffer fewer distractions, such as athletics and other extracurricular activities. Men much more often spend excessive amounts of time at outside work. College women are generally more carefully supervised than are the men. These reasons, together with other less apparent ones, account for the fact that girls generally have higher scholastic records in coeducational institutions, where selective methods for the two sexes are much the same. However, with changing social, economic, and moral standards, the differences between the aims and treatment of the sexes are becoming less and less, and we may well look forward to a time when at least some of the differences that now exist will disappear.

### Sex Differences in Interests and Attitudes

Incidental reference has already been made to some differences in interest, attitudes, and subjects of conversation between the sexes. Probably in this field more differences exist than in almost any other. Unfortunately, we have relatively few experimental studies that bear directly on this subject.

One study of preschool children which analyzed the vocabularies of the children showed that boys excel in knowledge of minerals, animals, and occupations. Girls are more familiar with things about the home. In play, there are some sex differences, with girls showing more interest, as might be expected, in dolls and playing house. Boys play with mechanical toys and engage in more active outdoor games. In a further study of play interests, Lehman and Witty[30] found that there is practically no game which belongs exclusively to one sex. The greatest difference between the sexes in play occurs at the ages of nine and ten. After this age, the study seemed to show the rather surprising fact that the play interests of the two sexes again grow more alike.

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[29] Lincoln, E. A., *Sex Differences in the Growth of American School Children,* Baltimore, Warwick and York, 1927.

As has already been stated, boys excel in mechanical skills. However, this partly depends upon the skills tested. One study[31] of fourteen- and sixteen-year-old boys and girls showed boys to be superior in assembling a wheelbarrow and a cradle. They also excelled in solving the Healy puzzle box, assembling painted cubes, and with the McDougall plunger. (The boys exceeded the girls' median in from 63 to 85 per cent of the cases tested). On the other hand, in assembling a girl's dress and a boy's coat, the girls excelled in 87 per cent of the cases.

Using Strong's Interest Blank,[32] it was found in a comparison of the interests of 100 pairs of unlike-sexed twins that boys ranked highest in: (1) engineering; (2) chemistry; (3) farming; (4) physics; and (5) purchasing. The girls ranked highest in: (1) certified public accounting; (2) advertising; (3) life-insurance salesmanship;

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[30] Lehman, H. C., and Witty, P. A., *The Psychology of Play Activities,* New York, Barnes, 1927.

[31] McFarlane, M. A., "A Study of Practical Ability," *British Journal of Psychology Monograph Supplement,* Vol. VIII (1925), p. 75ff.

[32] Carter, H. D., and Strong, E. K., "Sex Differences in Occupational Interest of High-School Students," *Personnel Journal,* Vol. XII (1933–1934), pp. 166–175.

(4) journalism; and (5) city school superintendence. Although all critical ratios were above three, those for the boys' selections were much greater than those for the girls'.

One of the best quantitative studies of sex differences in attitudes was made by using the Allport-Vernon test for the study of values.[33] This test measures six different values by which any individual or group of individuals views the world. It was given to 462 men and 313 women. Men were found to be higher than women in theoretical, economic, and political values, while women were higher in aesthetic, social, and religious values. These results confirm the common-sense views on sex differences with respect to these attitudes.

Much remains to be discovered about sex differences in interests and attitudes. With scales like the Thurstone attitude scales (see Chapter X), by which attitudes may be measured, it is surprising that more information has not been collected on this question.

### Sex Differences in Character and Morals

Another important place for studying sex differences is in the field of character. Are there reliable differences between boys and girls and between men and women in moral traits? In an extensive study of these problems, Hartshorne, May, and others[34] constructed objective tests of: (1) deceit, including cheating, lying, and stealing; (2) service, including coöperation and charitable behavior; and (3) self-control, including persistence and inhibition. Over 10,000 children were studied in the deceit tests. The tests consisted in such tasks as determining how often in examinations children copied answers from other children. Another was a "paraffin-paper test," in which the children were allowed to grade their own examination papers. The tests were so arranged that, when folded for grading, any changes made at that time were recorded on a paraffined paper. Another test consisted in having children make crosses with their eyes closed in a series of circles drawn on a sheet of paper. No child could accomplish this task without peeping, and any high score on the test was evidence of cheating. In another test, the children were given money to buy with at a store and the storekeeper was instructed to give them too much change in return. The proportion who returned the additional change constituted an approximate measure of honesty. In another test, children were given boxes with coins to count. Opportunity was provided for the child to take some of the money. A coding system made it possible to check up on the boxes from which money was taken.

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[33] Allport, G. W., and Vernon, P. E., "A Test of Personal Values," *Journal of Abnormal and Social Psychology,* Vol. XXVI (1931), pp. 231–248.

[34] See Hartshorne, H., and May, M. A., *Studies in the Nature of Character,* Vol. I, New York, Macmillan, 1928; Hartshorne, H., May, M. A., and Maller, J. B., *Studies in Service and Self-Control,* Vol. II, New York, Macmillan, 1929; and Hartshorne, H., May, M. A., and Shuttleworth, F. K., *Studies in the Nature of Character,* Vol. III, New York, Macmillan, 1930.

Persistence was tested by the time children spent in solving puzzles. The more time they spent, the more persistent the children were believed to be. In a test of coöperation or service, among other tests, children were given pencil boxes containing ten articles. They were then asked to give some of the articles toward boxes for poor children. Scores were in terms of the objects given for the poor. In the inhibition tests, children were assigned some interesting task and then asked to do something uninteresting before completing their task.

Despite such elaborate tests, no significant sex differences were discovered in school children. Some of the tests for honesty showed the boys to be more honest and others the girls. When the tests were averaged, the scores for the two sexes were very similar. In the tests for service and self-control the girls ranked slightly higher than the boys (C. R. 1.9), and they were regarded as much more reliable by their teachers. In persistence and inhibition the girls also ranked higher than the boys, both in scores and in the opinion of their teachers.

As a much more practical measure of the absence of moral virtue, we may compare the number of inmates in penal institutions in this country. At the beginning of 1935, there were 133,769 men and 4,547 women in State and Federal prisons—almost thirty men to one woman. Of course, in comparing these figures, we must realize that a man is more likely to be sent to prison than a woman who commits a similar crime. Furthermore, most crimes are either directly or indirectly due to economic causes. This is shown by the fact that the largest number of people are sent to prison for robbery, burglary, and larceny. Women as a rule are not so subject to stress or temptation in these fields. However, this argument does not account for the importance of sex differences in crime. We do not have any equally good measure of the opposite picture of morals. In other words, we do not know the relative proportion of men and women who are our moral leaders.

## Emotional Differences Between the Sexes

In the discussion of physical differences between the sexes, it was noted that, in addition to size, there were certain glandular differences between the sexes. Chief of these are the sex glands, but others—such as the thyroid and pituitary—also vary. These glandular differences, among other influences, have a large part to play in the emotions. Unfortunately, no very satisfactory technique has been developed to measure the emotions. Therefore this part of the discussion must be based largely upon common observations, rather than upon measurable differences. This, however, need not minimize the importance of the subject for us.

Physiological changes and the corresponding emotional changes vary greatly for the various ages. Emotions exist during infancy and youth, but there is relatively little difference between the emotions of boys and girls. The changes which occur at the onset of puberty form the basis of sex changes in emotions. It is at this time that boys and girls begin to differentiate their behavior toward the opposite sex. Too much emphasis has been placed upon the changes that occur at adolescence; nevertheless, as already stated, there are both physiological and emotional changes of significance. Part of the emotional changes depends upon the knowledge of the development of sex functions in boys and girls. The boy, conscious of his sexual maturity, is susceptible to and stimulated by members of the opposite sex in a new way. The girl becomes more self-conscious and shy.

Dunlap[35] believes that there is a difference in the nature rather than in the strength of the sex drive. In the male, the drive is specific and may be aroused toward any member of the opposite sex; in the female, it is more general. Only through training does it become attached to a specific object or person, but when aroused, the impulse is very strong. Because of this fact, Dunlap urges the importance of the right kind of sex education for both girls and boys, especially for girls, since the dangers inherent in illicit attachments are likely to be very great for them. He points out the danger that such education may be only sexually stimulating and not healthful. In the early years it should be incidental to biological training and specific only when demanded by the child.

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[35] Dunlap, Knight, *Social Psychology,* Baltimore, Williams and Wilkins, 1925.

In early times and among primitive races, elaborate ceremonies were developed to initiate boys and girls at the onset of puberty into the adult world. Even in civilized communities such ceremonies still exist, and various institutions have been set up in this connection—such as confirmation in church and differentiated programs and departmentalized teaching, as well as additional extra-curricular activities, in junior high school. This is a recognition on the part of its elders that the child has grown up and is now to be treated more as an adult.

Especially in the girl there is a heightened emotionality, which shows itself in various ways. There is also the rather important cyclic change, which increases this emotionality at certain times, in addition to the important physiological and emotional changes accompanying child-bearing and maternity, which further differentiate the sexes. It may be seriously questioned as to how much of the so-called maternal instinct is innate, but there is no doubt that the glandular and other disturbances connected with gestation and childbirth do have a profound effect. These, together with the social adjustments which occur with the presence of a child in the home, are sufficient to account for the emotional changes in the life of the mother.

There are many practical problems connected with sex differences. One of these is the question of training. Recognizing that many of the so-called sex differences found in our culture are the direct result of training and, at most, can only be said to be the indirect result of sex.

we still can ask ourselves how much similarity and how much difference in amount and kind of formal education should be provided for members of each sex. Should the same percentage of women go to college as men, and should they take the same kinds of courses? Sex differences in emotions, as well as the more practical considerations of woman's usual place in society and a declining birth rate, will need to be taken into account in discussing such questions.

A pronounced difference in practice exists between the East and Southeast and the rest of the country in the attitude toward coeducation. In practically all the colleges in the East and in many of those in the Southeast, the sexes are separated for their college work. This separation often occurs at the high-school level, which accounts for the large numbers of academies and finishing schools in this section of the country. In contrast with this practice, the rest of the United States is almost entirely devoted to the idea of coeducation, both at the high-school and college level.

## Sex Differences in Personality

With one exception, discussions of sex differences in personality have been even more inconclusive than the other sex differences we have studied. Terman and Miles[36] constructed a test for measuring masculinity and femininity. Although the purpose of this test was not primarily to discover sex differences in personality, several such differences were established in the course of the study as an important byproduct. Even the character of the subtests from which the masculinity-femininity test was constructed is of interest, since it indicates seven large fields in which the sexes differ. In interpreting the results of these subtests, we should bear in mind that no attempt was made to distinguish between those differences which are the direct result of sex and those which are the indirect result of being a man or a woman in our society. These subtests were not based merely upon opinion but upon extensive investigation of fields in which the sexes differed. Scoring methods were also devised in order to emphasize these differences.

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[36] Terman, L. M., and Miles, C. C., *Sex and Personality*, New York, McGraw-Hill, 1936.

Subtest I was a controlled association test like the following:

| | | | | | |
|---|---|---|---|---|---|
| 1. | pole | barber | cat | north | telephone |
| 2. | date | appointment | dance | fruit | history |
| 3. | bar | drink | prisoner | sand | stop |
| 4. | sharp | bright | flat | knife | pin |
| 5. | trunk | baggage | elephant | travel | tree |

The subject was instructed to underline one of the last four words that seemed to go best with the first word. Like the rest, this exercise was given to representative groups of males and females of various ages. In the first subtest, females tended to pick the names of domestic things or things suggesting kindly or sympathetic activities, such as articles of adornment and colors. Men, on the other hand, selected scientific and business terms, and words suggesting excitement and adventure. Each sex preferred names of persons of its own sex.

Subtest II was an ink-blot association test, with four possible associated names for each ink blot. In this exercise, men checked words relating to machinery, science, outdoor activities, and adventure. Women checked words relating to domestic occupations, aesthetic experiences, and personal adornment.

Subtest III was a multiple-choice informative test, of which the following is an example:

| | | | | | |
|---|---|---|---|---|---|
| 1. | The "Glass Slipper" reminds us of: | Ali Baba | Cinderella | Goldilocks | Queen Mab |
| 2. | Electric lights were invented by: | Ampere | Edison | Marconi | Volta |
| 3. | Mayonnaise dressing is used with: | cakes | pies | puddings | salads |

In this exercise females showed greater knowledge about domestic occupations, household and individual embellishment, etiquette, fictional literature, music, and topics that have a human-interest appeal and arouse the maternal instinct. Males were much better informed on politics, business, economics, scientific and physical facts, exploits, adventures, inventions, and topics associated with aggressive body activity.

Subtest IV concerned emotional and ethical responses. Lists of things that might elicit anger, pity, or disgust or suggest wickedness were arrayed so that the men and women could each check four degrees of each emotional or ethical attitude. This exercise indicated that women show more anger at unsympathetic or cruel treatment of others, and that they are more disturbed by social offenses and less by business troubles. It appeared that women tend to express a higher degree of each of the four emotions, anger, pity, disgust, and moral censure, than do men.

Subtest V consisted in a study of interests. This was patterned somewhat after the strong-interest test. As might be expected, women indicated a stronger preference for indoor, aesthetic and decorative, and directly "ministrative" occupations. Men preferred adventure, bodily risk, muscular strength, or prolonged exertion.

Subtest VI concerned personalities and opinions.

Women showed a preference for women, unfortunate people, and philanthropists; men, for successful generals, sports heroes, and the unconventional.

Subtest VII, dealing with introvertive responses, showed females to be more introvertive than males.

The differences discovered by the masculinity-femininity test may at first seem trivial and just about what anyone might expect to find. Yet here we have concrete objective evidence of these differences. Some idea of their magnitude can be realized from the fact that, when scored by the method devised for use in this test, men and women presented an almost completely bimodal distribution, with only about ten per cent of overlapping. The mean total score for college men was +67.4 and for college women −60.8. Men and women do differ in their ideas, attitudes, and emotions, and these are some of the most significant variations between the sexes.

Significant changes were found in test scores for different ages and educational groups. The greatest differences between the sexes occurred in the eleven-year group. After this age, the sexes became more and more alike. This change was due largely to the reduction in the masculinity scores for men. Women lost slightly for the higher ages but not nearly so much as the men. It is a question whether this loss in masculinity score was due to an actual loss in sexual vigor or to greater social and cultural similarities between the sexes as they grew older. The results not only show these age changes for different decades but also show these differences for people with grade-school, high-school, and college educations.

The authors raise the question as to whether the differences they discovered are due to nature or nurture, but maintain that there is no evidence to indicate the relative importance. They also state that they may not have sampled all or even some of the most important personality differences. However, their investigation was carefully planned and was carried out only after extensive preliminary exploration. It seems likely that most of the significant personality differences were tapped in the study.

### General Considerations Concerning Sex Differences

In considering differences between men and women, we are immediately confronted with the question as to the causes of these differences. Differences in training will account for many differences in attitudes and knowledge, but the extent to which this differentiated training is itself due to innate sex differences can scarcely be estimated. True sex differences are biological in origin and are inherited with the determiners of sex. They are the kind of differences which would not be eliminated by giving men the training and occupations of women and women those of men.

Certain sex differences in physique have been pointed out for both children and adults. While such differences are numerous, the differences among individuals of one group are almost always very much greater than the differences between the averages of the two groups. Similarly, age differences among younger children are usually greater than sex differences; for example, there are usually greater differences betwen five- and six-year-old boys than there are between boys and girls of six years. Observed sex differences in certain motor skills of children and even some of adults[37] have tended to disappear during periods of practice. Girls often compensate for some of their usual inferiority by learning more than boys in a given amount of training.

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[37] For an interesting study of adult sex differences in motor skills, in which a period of training reduced sex differences to nearly nothing in one test and left unchanged the results of another where there was no

Studies of sex differences in adults are made difficult not only by the fact that, during childhood, men have had greater freedom of action and a more varied experience than women, but by the fact that adults as individuals, both men and women, have had experiences extremely varied and different from each other. It is extremely difficult to assemble a group of men as subjects of a study who represent all men just as truly or with the same bias as a group of women represent all those of their own sex. Not only are sex differences hidden by characteristic differences in training and experiences, but there is great difficulty in getting truly representative samples of the two sexes for studies. College students—those adults so easily available and so frequently used for psychological studies—are of doubtful value for certain studies of sex differences, for, as we have already seen, the women are much less numerous in college and therefore probably more carefully selected for their intellectual traits.

There is considerable evidence that girls and women have more language ability than boys and men, and it appears likely that there is a true sex difference in this special ability in favor of the female group. Similar evidence, although not so extensive, exists for male superiority in mathematics. The best interpretation of the data on general mentality appears to be that neither sex is endowed with general intelligence at the expense of the other. While most investigators have agreed that the average general ability of the two sexes is the same, some

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initial male superiority, see Husband, R. W., and Ludden, M. J., "Sex Differences in Motor Skills," *Journal of Experimental Psychology,* Vol. XIV (1931), pp. 414–422.

have thought that men were more variable than women and that there were more men at the upper and lower levels of general ability. If it could be proved that greater variability existed among men, it would be very useful in explaining, at least in part, the greater number of eminent men as well as the greater male population in institutions for the feeble-minded. Although many studies have given data on the variability of the subjects used, the hypothesis of greater male variability has not yet been established.

The fact that boys and girls in our culture are given characteristically different training from a very early age can scarcely be overlooked by anyone. That this differentiated training affects emotional expression and personality traits is only slightly less apparent. Yet if all necessary allowance were made for differences in training, it is likely that there would still remain some characteristic differences in the emotional life and personalities of men and women. Whatever these innate differences between the two groups may prove to be, they will certainly be smaller than individual differences found within either sex group.

### Exercises

1. What are some of the sex differences in motor skills which have been observed among children? Give possible explanations for these differences.

2. List reasons for the observed differences in subjects of conversation of men and women. Do these reasons fall under any one category?

3. Name ways in which the development of mechanical motive power is changing the place in our society: (*a*) of men; and (*b*) of women.

4. What explanations can you give for the fact that studies of small children have very frequently shown that, on the average, girls

begin to talk earlier, have larger vocabularies, and construct better sentences than boys of their own age?

5. What evidence is there that a certain proportion of color blindness is a sex-linked recessive?

6. Comment upon the possibility that differences in the sexes which appear years after birth may be due primarily to inheritance and be true sex differences.

7. Name some characteristic differences between young men and women which are not directly due to inheritance and which can be imagined not to occur in another culture.

8. What significance, if any, do you attach to the fact that, on the average, women's brains are lighter than are men's?

9. Comment upon the use of twenty-five college women and twenty-five college men to determine sex differences which may or may not exist in the millions of men and women of our race. Is it likely that college women represent all women in the same way that college men represent all men? Are college men or women the more highly selected group?

10. Would you depend upon a study of a large number of college students to indicate which sex group in the general population has the higher average: (*a*) height; (*b*) intelligence; and (*c*) rate of reading?

11. In a careful study of sex differences with appropriately selected subjects, what significance would you attach to the finding that the percentage of men reaching or exceeding the median woman was: (*a*) 50; (*b*) 52; (*c*) 63, with a probable error of 2?

12. What are possible explanations of the fact that girls characteristically show higher averages in language work in schools, although most of the great authors of the seventeenth, eighteenth and nineteenth centuries have been men?

13. Offer explanations for the fact that young men have frequently been found to make higher scores than young women on tests covering the natural sciences. Would you consider this a true sex difference?

14. Name some occupations in which women: (*a*) rarely, if ever, engage; and (*b*) have most frequently become eminent.

15. Point out differences in educational opportunities for men and women: (*a*) seventy-five years ago; and (*b*) today?

16. Mention some of the characteristic differences in the treat-

ment of daughters, as compared to sons, in the average: (*a*) American family; and (*b*) Polish family.

17. Name some environmental conditions which can be invoked to explain observed sex differences in achievement. Are the conditions which you are able to name sufficient to explain all such differences?

18. In using large numbers of high-school students for studies of sex differences, what differences may be found which are not characteristic of the entire population of high-school age?

19. How do individual differences which occur within a sex group compare with the differences which are usually found between the averages of the two sexes?

20. How has the concept of greater male variability been used to explain in part the greater achievement of men, as compared to women?

21. Mention conditions in our society which oblige a relatively higher percentage of feeble-minded men, as compared with feeble-minded women, to live in asylums.

22. In studies of psychological differences, of what importance, if any, is the fact that girls reach puberty and attain adult stature earlier than do boys?

23. How great must differences be between groups before we may be reasonably sure that such differences are not the result of chance? What statistical constant is computed to estimate the likelihood that a difference is not due to chance?

24. Enlarge upon the following statement: "The mechanism of inheritance gives us good reason to believe that the mental traits of the sexes are genetically alike."

25. If a large group of boys and girls with identical intelligence-test scores is selected from the same grade in school (for example, all in the sixth grade and all having an I.Q. of 100), which sex group may be expected to have the higher average school grades? Will the average ages of the groups be different?

26. If one desired to make a "general intelligence" test which would favor girls and women, what subtests would he use? What subtests would he use to favor boys and men? If an intelligence test is somewhat weighted with subtests which favor girls, can it be said necessarily that this general test has too many such subtests?

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## CHAPTER VI

# Race Differences

### The Meaning of Race Differences

In popular use, the word "race" has several meanings. According to current terminology, the inhabitants of Paris, for example, are said to belong not only to the French race and to the white or Caucasian race but are spoken of also as Nordics, Alpines, or Mediterraneans. They are also often called Latins and not infrequently Aryans, and some among them are said to belong to the Jewish or Semitic race. Thus one particular person might be classified as French, white, Alpine, Latin, and Aryan. Other Parisians might be assigned to slightly different groups or racial classes, while many of the inhabitants would be said to be mixed in respect to the Nordic, Alpine and Mediterranean subdivisions. The inhabitants of Chicago would be given an even greater variety of racial groupings, because of the many immigrant groups and the common practice of speaking of national groups as races.

Associated with these several different and not mutually exclusive "racial" classifications are many notions as to the mental traits characteristic of each group. Indians are frequently spoken of as brave, the Negroes as easy-going, the Chinese as honest, the Scots as canny, and the Irish as witty and pugnacious. These expressions and many others like them are indicative of the almost universal belief that large groups with similar remote ancestry have at least some distinguishing mental traits and that race differences are actually manifested in other than purely physical traits. The problem of the psychologist of race differences is not only to discover and describe the mental characteristics of a race but to determine, if possible, which of the distinguishing characteristics are due to the remote ancestry common to the entire group. If psychologists of race should be altogether successful in describing the inherited mental characteristics of a large number of racial groups, then we might conceivably be able to indicate which of the mental traits of an individual were to be expected in him because of his membership in a particular racial group.[1]

Before discussing any of the psychological traits of racial groups, however, we should first attempt to get some satisfactory definition of a race. Naturalists and ethnographers have devised many methods of grouping humanity into races, but each of their methods has at least two essential characteristics. First, racial groupings are made on the basis of some physical trait or group of traits which is possessed by all. This does not mean that each of the identifying characteristics is possessed to an equal extent by each member of the race, but that each "pure" member has the identifying traits at least to a certain extent. No matter what methods of racial classification are used, there will be many persons who do not fall definitely into any one category, for there will be many examples of mixed races. A second characteristic of the scientist's classifications is that the identifying traits are always inherited. Thus, although there are many one-eyed men in the world and some languages have a special word to designate them, no anthropologist has yet set this group aside as a separate race. On the other hand, skin color, head shape and size, certain facial measurements, and other inherited physical traits have frequently been used as a basis for racial classification. As implied in the two above-mentioned characteristics and by common understanding, we generally assume that the members of a single racial group have the same remote ancestors from whom they have inherited their common physical traits.

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[1] For an interesting discussion of this point of view, see McDougall, William, *Is Democracy Safe for America?* New York, Scribners, 1921.

Since the word "race" in its original meaning has to do with people of the same stock or lineage, and since the divisions of mankind into races by the scientists are on the basis of inherited physical traits, it may be well to question some of the racial classifications which are frequently found in semipopular articles and even in psychological journals. Political groups or nations are usually not at all separate groups having a common remote ancestry and therefore cannot be spoken of as separate racial groups. It is a misuse of the term to speak of the French, the Belgians, and the Dutch as being separate races. A large proportion of these three nationalities do have some very remote ancestry in common, presumably, since most of them do belong to the white race; but the racial subdivisions among them do not follow the political boundaries of the nations referred to. Some of the smaller groups of persons who resemble each other to a certain extent and who may be supposed to have some ancestors in common have representatives in both France and Belgium or in both Belgium and Holland. The rapid migration of people in modern times has been partly responsible for the fact that national boundaries include many slightly different racial groups and yet fail to include all of any one group. The confusion of "nationality" with "race" is in general to be avoided as not only meaningless but, in some cases, as misleading.

Popular discussions of the questions of race are replete with the word "Aryan." This word is properly applied to a branch of the Indo-European group of languages, although at times it has been used as a synonym for Indo-European. As a term to designate a language group, Aryan has little value as the name of a race, because it is certainly impossible to expect biological inheritance and language to remain identified with each other over a period of many centuries. Attention need only be called to the varied origins of those who speak English on the mainland of America, not to mention Hawaii, to know that having a language in common is little proof of common remote ancestry. The words "Latin" and "Semitic" are terms for students of languages and as such may be used with accuracy only to designate these two language groups. Persons speaking a language of Latin origin are sometimes considered as all belonging to one race and set off in their physical inheritance from the remainder of mankind. Since the variety of inherited traits, at least of inherited physical traits, in Latins is duplicated by other Europeans, there is very little reason to believe that Latins have a common unique ancestry. It will therefore be very difficult for us to conceive of any mental trait which they may be found to possess in common as the result of biological inheritance—that is, as a true race difference.

Even religious faith has been the historical reason in at least one case for setting apart a group which later came to be considered as a separate race. The Jewish group, to which reference is here made, cannot with any degree of certainty be assumed to have sprung from a group of common ancestors. The very fact that Jews usually bear some resemblance to the national groups of which they form a part is evidence that they have mixed somewhat with the non-Jews and consequently share their ancestry. Because of social as well as religious reasons, Jews have often been set apart as a separate group, and being identified as such, have frequently been called a separate race.

As already indicated, racial classification is made by the anthropologists exclusively on the basis of inherited physical characteristics. But there is no general agreement among them as to just which physical traits are to be used in dividing mankind into races. The number of different races, and of course their size, is a matter upon which there is a variety of expert opinion. The most widely used and the oldest classifications of man into races are those based on skin color. Of these the simple classification of Blumenbach is perhaps the best known. He divided *Homo sapiens* into five races, namely: the Caucasian or white, the Mongolian or yellow, the Negro or black, the American or red, and the Malayan or brown. Much more elaborate classifications based on face and head measurements (especially the cephalic index), body structure, and hair types have been suggested and used by different students. In passing, mention should also be made of the three European subgroups of the white race, the Nordics, the Alpines, and the Mediterraneans, which are so often encountered in most discussions of race.

Whether we accept the polygenic theory of the origin of the human race or the much more generally held theory that there was but one group which made the transition from our prehuman to present stage of development, we can scarcely believe that any race today is in any sense "pure." Even the very simple classification of races by color mentioned above is by no means easily applied to every individual. Omitting individuals such as natives of Hawaii, whose recent ancestors came from the South Seas, Asia, America and Europe, there are still many who can be assigned only with difficulty to one of the color groups. A great variety of pigmentation is to be found among the white race, and full-blooded Negroes are by no means all equally black. Occasions for finding difficulty in classifying a person as belonging to the yellow or brown race are, of course, very much more frequent. Where European whites are being considered, even greater difficulty is often encountered in classifying persons as members of the Nordic, Alpine, or Mediterranean subraces. Indeed, a person is often said to be more Alpine than Mediterranean, or more Nordic than Alpine, and so forth. Some Northern European visitors of the World's Columbian Exposition at Chicago, who submitted to anthropometric measurements, were surprised to find that they were only, let us say, "seventy per cent" Nordic—that is, seventy per cent of the bodily measurements taken fell within the limits of those measurements which could be designated as Nordic. Since some investigators have found that less than one third of the Swedes are "pure Nordics," any question concerning the 100 per cent Nordic purity of other countries need scarcely be raised. Such assertions may have political expediency but can have little basis in scientific fact. Certainly the classification of a large population as Nordic, Alpine, or Mediterranean can mean little more than that a particular population has more of the traits of one of these subraces than of either of the other two.

Furthermore, it is not to be assumed that at one time the ancestors of the modern Europeans lived in Europe as three separate groups—pure Nordics, pure Alpines, and pure Mediterraneans—which have since become somewhat intermingled. While this may possibly have been the case, or it may have been that there were three groups of forebears which somewhat resembled these three subraces, it is also possible that, when rigidly defined, these three subraces would be found to be scientific abstractions, which have never had more reality than they do at present. What are known as characteristically "Alpine" traits may never have been the sole possession of any of the ancestral groups of modern Alpines; there may never have been a "pure Alpine" group in the ancestry of man. Whether the Nordic, Alpine, and Mediterranean groups, as defined by scientists, are becoming a little more or a little less clearly differentiated is difficult to determine. The assumption of either implies that races are mobile and are not forever fixed with definite, unchanging characteristics. In fairly recent years, some investigations have indicated a partial instability of some of those features which are sometimes used as the basis of racial classifications.

Now that we have accepted a definition of race in terms of inherited physical traits common to rather large groups of people and which are presumably due to common remote ancestry, let us examine the possibility that these races which we have identified have common psychological traits which, on the average, are different from those of other races. If mankind is divided into groups on the basis of physical characteristics, will these groups at the same time be divided according to their mental capacities? Studies based on subjects which were quite homogeneous in respect to race have indicated that there is very little correspondence or relationship between physical and mental traits. This fact does not entirely preclude the possibility of mental differences between races. Indeed, two *a priori* arguments have been presented to indicate that we should expect to find mental differences between races. According to the first of these, mind is a result of evolutionary processes, and because the bodies of different races have developed along different lines, it may also be expected that the mental abilities of different races have likewise developed along different lines. Different races have developed different observable physical characteristics and may also be supposed to have developed somewhat different central nervous systems. Since mental life is intimately dependent upon the central nervous system, we should, according to this argument, expect differences between races in mental abilities. The second *a priori* argument for mental differences is based on the selected influence of environment. The course of inheritance, including mental inheritance, is assumed to have been somewhat dependent upon the selective nature of the environment in which the race has spent many, many centuries. It is assumed that a rigorous environment would demand a little different quality of mental ability for survival than would a simpler one. Since the several varieties of mankind are found in quite different types of environment, it is argued that these differences in environment should at least slightly modify the average mental abilities of some of the races.

While these are very attractive arguments for one who is looking for mental differences between races, they must not be accepted as established fact without supporting evidence. Both arguments could be urged as reasons for not expecting to find the same sensory acuity in different races, or for expecting to find that some races had much better hearing, sight, or sense of equilibrium than others. A number of studies have been made in the field of sensory acuity which, although they do not agree in all details, do seem to indicate that there are no real differences between races in sensory acuity, and that such differences as do appear are due to differences in the training of the powers of observation.

Such features as eye color or pattern of fingerprints are generally considered as being the product of inheritance. They exist as potentialities in the newly formed cell resulting from the union of the ovum and a spermatozoon, and to become realities need only those conditions for the development of any such a cell. Only under extremely unusual conditions, if at all, will the nature of these features be modified when they develop. Quite different in origin, however, are such psychological traits as attitudes. One's attitudes toward a political party, the church, one's parents, the property rights of others, and the like are certainly not determined directly by the biological determiners, or genes, of inheritance. These attitudes are primarily the result of the experiences of the individual and are only to a very small extent the product of inheritance. Imagine a scale of inheritance extending from low to high —from a point as low as the contribution of inheritance toward the development of psychological attitudes to one as high as the great contribution of inheritance toward the development of a physical trait such as eye color. This scale of the contribution of inheritance would cover so great a range that most, if not all, of the traits of human beings whose origin we might discuss would fall somewhere along its range. Such a physical trait as one's weight, relative to others of his sex and age, would probably come in the upper part of the scale; while one's coöperativeness, being somewhat less a matter of inheritance, might fall in the lower half of the scale.

Any trait falling at the high end of the scale and found to differ from race to race could certainly be called a true race difference. The possession of any such trait by an individual could be attributed to membership in his race; it could be attributed to the remote ancestors which he has in common with the other members of his race. A trait falling at the lower end of the scale, depending only slightly upon inheritance and found to differ from race to race might not, and indeed probably would not, be a true race difference, for it can very easily be imagined as dependent upon varying conditions and modes of life of different races. Because the mental traits as measured which concern the race psychologists certainly fall somewhat away from the high end of our scale of inheritance, great care will need to be taken in interpreting the crude results of studies of race differences in such traits. Any race differences found may, though not necessarily, be due to something other than inheritance and will therefore not be true race differences.

## The Measurement of Race Differences

From the preceding discussion of race, let us proceed to a summary of the principal studies of race differences. While race has been defined in terms of inherited characters, the following discussion will not be limited strictly to comparative studies of racial groups. It will also include studies which have been made between nationality groups and other groups, such as the Jews. The studies will deal for the most part with mental differences, though in some cases they will also include physical characteristics of a race. In some cases—especially with the Negro—the mental comparison will extend to several different fields. For other races the discussion will be limited almost entirely to differences in intelligence.

With the advent of intelligence tests, it seemed possible for the first time to make accurate comparisons between the races. But such a comparison is not as easy as it at first seemed. Klineberg[2] has made one of the best analyses of why, in differentiating between races, we must often be very cautious about accepting the results of intelligence tests at face value. One of the most important reasons for variations in scores which are not true measures of race differences is *motivation.* A real cause of differences in intelligence test scores between Negroes and whites, he believes, is that the whites as a rule are more interested in making good scores. Our highly competitive civilization emphasizes speed and "taking a chance," both of which are important factors in making a good score in most tests.

*Rapport* is another factor in good test results. The fact that tests have usually been administered by whites may be a factor in race differences.[3] Porteus[4] tells of testing a school child near Turin, Italy. After the test, the teacher showed him a theme the child had written for another class. It read: "Today a foreign doctor came to the school and the teacher told me to go alone with him into another room. I was terribly afraid and commended myself to the Holy Virgin. As I left the classroom I asked Pietro to say Ave Maria for me. But the doctor only wanted me to do some puzzles for him." This story may illustrate a rather extreme case, but it does indicate some of the difficulties in securing rapport, especially with foreign children.

Under *culture* may be included the customs of different peoples which affect their attitude or method of taking tests, as well as their stock of information and knowledge. As indicated elsewhere, the kind as well as the amount of information of different races is varied. The virtues and common fund of knowledge of the Chinese or the American Indian of our Western plains is much different from that of our own urban population. If one of our early American Indians were to have constructed a test of intelligence, he would probably have included ability in tracking and catching wild animals, the care and treatment of meat, and the making of clothes from furs. In much the same way, some city children would do relatively poorly on a test constructed by a person who had spent his life on a farm. How many city children, for example, would be able to tell the names of the female or young of such animals as the horse, cow, hog, deer, or fox; or how would they define such words as "trace," "elevator," or "fork"? In contrast, the country-bred child would have equal difficulty with or would give different meanings to words concerning the city.

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[2] Klineberg, Otto, *Race Differences,* New York, Harpers, 1935.

[3] A study by Canady, in which the same colored children were tested by both a white and a colored teacher, showed close correspondence between the two sets of scores. See Canady, H. G., *Effects of "Rapport" on the I.Q.,* Master's thesis, Northwestern University Library, 1928.

[4] Porteus, S. D., *The Psychology of a Primitive People: A Study of the Australian Aborigine,* New York, Longmans, Green, 1931.

These illustrations show how difficult it is to measure the true ability of any race or to compare one race fairly with another race having different ideals, customs, and funds of information. The following pages will give a summary of comparisons. Often much more has been claimed for the significance of the differences found than can be justified when the factors mentioned above are taken into consideration.

Until relatively recently, psychologists and anthropologists of the white race for the most part took the superiority of their own race for granted. More recently men like Boas,[5] Garth,[6] and Klineberg,[7] have questioned such a point of view. Many of the older premises have been proved unfounded, and many of the earlier studies of race differences have been found faulty in method and unwarranted in their conclusions.

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[5] Boas, Franz, *Anthropology and Modern Life,* New York, Norton, 1928.

[6] Garth, T. R., *Race Psychology,* New York, McGraw-Hill. 1931.

[7] Klineberg, *op. cit.*

## The Negro

**Physical characteristics.** It must be remembered when we discuss the Negro race that there are approximately 175,000,000 members of this race, of which about 13,000,000 live in this country. It includes a wide variety of types, such as the Papuans, Negritos, Lilliputians, and Pygmies, as well as some giant races of Central Africa. The representatives of the race who live in the United States are by no means a homogeneous group, but since the large majority of them are descendants of slaves imported from a relatively small area along the western coast of Africa, they are more alike than a chance sampling of the whole race. No adequate study has been made of the Negro in Africa. We, of course, are more interested in, as well as more familiar with, the Negro in this country.

When compared with the white population of the United States, the Negro presents small but significant differences in physical structure. Negro infants[8] on the average are smaller than whites. Soon after birth, the Negro averages reach and then exceed the white averages. They retain this position up to adolescence. From that point onward, whites exceed Negroes in both height and weight.

In health, whites are superior at all ages. Negroes have a higher infant mortality, it being almost double that for whites at all ages. Of course, we cannot tell whether this is due to an inferior physical constitution, to poorer medical care, or to both. It is generally recognized that Negroes have inferior medical care and as a rule only emergency hospital attention. Unless medical care is equated for the two races, we cannot know how much of the differences in sickness and mortality statistics is due to true race differences.

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[8] Woodbury, R. M., *Statures and Weights of Children Under Six Years of Age,* Bulletin No. 87, Children's Bureau, United States Department of Labor, pp. 1–117, 1921.

Negroes have certain physical characteristics other than color, height, and health which are ordinarily assumed to be correlated with race. Some of the more apparent of these are:[9] thick lips; black curly hair, which is generally thick and heavy; a broad nose; and a relatively small cranial capacity. Other less apparent physical characteristics were brought out by a comparison of Negro and white men who were drafted during the World War.[10] This study shows that the Negro had relatively longer legs and arms, a shorter and more circular trunk, a narrower pelvis, a shorter neck, and a larger leg. "The Negro seems more powerfully developed from the pelvis down and the white is more powerfully developed in the chest." This last statement may of course account for the fact that there is relatively a much larger proportion of successful Negro college track athletes than their number in colleges would normally produce.

**Mental differences between Negroes and whites.** At first thought it would seem relatively easy to compare the mental abilities of Negroes and whites in this country. There are two ways in which such a comparison might be

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[9] For a more complete summary of physical differences between Negroes and whites, see Cobb, W. Montague, "The Physical Constitution of the American Negro," *Journal of Negro Education,* Yearbook No. 3 (1934).

[10] Davenport, C. B., and Love, A. G., *Army Anthropology,* Washington, D. C., Government Printing Office, 1921.

made. For example, all the members of each race might be tested. While theoretically possible, this is practically impossible. Another way of comparing the races would be by testing representative samples of each race. This method would be satisfactory as long as it were certain that the samples chosen were truly representative. But this condition is difficult to secure. The environmental factors of the two races are so different that it is difficult to make any fair comparison. A good many studies have been planned to establish the differences between whites and Negroes but, as we shall see, most of them have included one or more variables, such as the amount of schooling or the socio-economic status of the groups, in addition to that of race. These additional variables have seldom been either controlled or measured. Hence it is impossible to tell which of the two or more variables are measured in the test scores or the relative weights of each. Some of the more recent studies have attempted to hold the factors of socio-economic status or schooling constant. Unfortunately, most of these studies have covered so small a segment that we cannot be certain how representative the results are.

It seems that sometimes more might be gained by attacking the simpler problem of the differences between whites and Negroes *as they are.* It would be possible to compare groups of Northern Negroes, representative groups of Southern Negroes with Southern whites of different social standing, or representative groups of each race for the country at large. These results could be taken at full value as long as the tests are a fair measure of the groups. But this would not be a study of race differences as defined in this chapter; it would be a measure of the relative standing of the groups, irrespective of whether the factors which produced these differences were environmental or hereditary. We may frankly take this position or we may try to make allowances for the environmental factors and partial them out of the results. If the investigator claims to be studying race differences, readers must continually be on their guard in interpreting the studies in this field in order to determine that he has made proper corrections for the environmental factors.

The most extensive studies of the relative standing of Negroes and whites by means of intelligence tests were those conducted during the World War. Large groups of whites and Negroes from all over the United States were given the Army Alpha test.[11] The averages are given as follows:

| | *Number Tested* | *Mental Age* |
|---|---|---|
| White draft .......... | 93,965 | 13.1 |
| Negro draft .......... | 18,892 | 10.4 |

It might be claimed that the Army Alpha test is unfair to the Negro since it was constructed by whites, or it might be claimed that the Negroes were tested under very unfavorable conditions or were intimidated by the whites who gave the tests. Finally, it might be claimed that relatively fewer superior and more inferior Negroes were drafted into the army than whites. There may be some basis of truth in all these claims; however, as Pintner contends, it seems probable that the average scores for the two groups are not far from a true measure of difference between adults of the two races in terms of their *mental age*.

Two studies have dealt with the intelligence of Negroes in the period of later adolescence and as adults. Herskovits[12] studied 539 adult male Negroes at Howard University, Washington, D. C. This study did not give the test scores but it showed practically no relationship (−.198 to +.172) between intelligence test scores and width of nose, thickness of lips, and skin color. Such results indicate, as has already been stated, that there is no very close relationship between the physical traits which distinguish races and intelligence test scores.

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[11] Yerkes, R. M., *Memoirs*, Vol. XV, Washington, D. C., National Academy of Sciences, 1921.

Derrick[13] made a comparative study of fifty-five Negro students from two Southern colleges and seventy-five white college students. The Binet I.Q. for the Negro group was 103 and for the white group 112. Derrick attempted to study the social status of each of his groups but compared each with its own race and not with a common standard.

Many studies have been made of Negroes and whites in the schools. No less than twenty major investigations have been reported in this field since 1913. Table XIII gives a summary of these studies (revised after Pintner). From a survey of all these data, it is very apparent that Negroes almost always make lower scores than whites on intelligence tests.

What does this mean? Several attempts have been made to eliminate or measure certain factors other than race which influence I.Q.'s. Using the Taussig scale, Miss Arlitt,[14] for example, found that 63 per cent of the

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[12] Herskovits, M. J., "On the Relation Between Negro-White Mixture and Standing in Intelligence Tests," *Pedagogical Seminary,* Vol. XXXIII (1926), pp. 30–43.

[13] Derrick, S. M., "A Comparative Study of the Intelligence of Seventy-Five White and Fifty-Five Colored College Students by the Stanford Revision of the Binet-Simon Scale," *Journal of Applied Psychology,* Vol. IV (1920), pp. 316–329.

[14] Arlitt, A. H., "Further Data on the Influence of Race and Social Status on the Intelligence Quotient," *Proceedings of the American Psychological Association* (1920).

## TABLE XIII

A SUMMARY OF TYPICAL STUDIES OF RACE DIFFERENCES IN INTELLIGENCE

| *Year* | *Investigator* | *Number of Cases* | | *Test Used* | *Results* |
|---|---|---|---|---|---|
| | | *Whites* | *Negroes* | | |
| 1913 | Strong | 225 | 125 | Binet | Negroes 25% lower |
| 1914 | Phillips | 62 | 86 | Binet | Negroes retarded |
| 1915 | Pyle | ...... | 500 | ...... | Negroes below whites |
| 1916 | Ferguson | 486 | 421 | ...... | Negroes scored 2/3 |
| 1917 | Sunne | 112 | 126 | Binet and Yerkes | Negroes 1 year below |
| 1919 | Pressey and Teter | 1,022 | 187 | Pressey | Negroes 2 years below |
| 1920 | Murdock | 514 | 225 | Pressey | Whites .85 P.E. higher |
| 1921 | Arlitt | 199 | 71 | Binet | Negro I.Q. 83; white, I.Q. 106 |
| 1921 | Haggerty | 13,000 | 3,000 | Haggerty | Negroes overlap whites rural 19.9, city 14.3 |
| 1922 | Jordan | 1,504 | 247 | National | Negro I.Q. 75; overlap 20–25% |
| 1923 | Peterson | 841 | 734 | Pressey | Negro I.Q. 75 |
| 1923 | Peterson | 528 | 292 | Otis | Negro I.Q. 58 |
| 1924 | Sunne | 5,834 | 1,112 | National | Negroes below 1–1 1/2 years; overlap 14–33% |
| 1925 | Garth and Whatley | ...... | 1,272 | National | Negro I.Q. 75 |
| 1925 | St. Louis report | 8,998 | 1,574 | Pintner-Cunningham | Negro I.Q. 92; white I.Q. 100 |
| 1926 | Hirsch | 1,030 | 449 | Cunningham | Negro I.Q. 85; white I.Q. 98 |
| 1928 | Davis | ...... | 222 | Binet | Negro I.Q. 78 |
| 1929 | Peterson and Lannier | 119 | 86 | Three group tests | Negroes below .8–2.2 quartiles |
| 1929 | Kempf Collins | 677 | 399 | Different tests | Negro I.Q. 71; white I.Q. 88 |
| 1929 | Young | 323 | 314 | National | Whites 95% higher |
| 1929 | Gray and Bingham | 219 | 258 | ...... | Negro I.Q. 76; white I.Q. 108 |
| 1930 | Garth | ...... | 2,006 | Otis | Negro I.Q. 76–78 |
| 1932 | McAlpin | ...... | ...... | Kuhlmann-Anderson | Negro I.Q. 92–98 |
| 1933 | Beckmann | ...... | 1,100 | Binet | Negro I.Q. 96 |
| 1933 | Thurmond | ...... | 40 | Arthur | Negro I.Q. 84 |
| 1933 | Thurmond | ...... | 40 | Binet | Negro I.Q. 77 |

whites she studied fell in the two lower divisions of the scale, while 93 per cent of the Negroes were in these two classes. The median I.Q. for the whites of inferior social status was 92 and for the Negro 83.4. Beckham,[15] in a later study, obtained somewhat similar results. Miss McGraw[16] recently made an interesting attempt to eliminate the effects of social status by testing Negro infants under one year of age. The Negro infant I.Q. (Hetzer-Wolf baby test) was 92 for 60 Negroes tested, as compared with 105 for 68 white infants. Only 28 per cent of the Negroes reached the average for the whites. If these cases were representative, it either means that environmental factors are effective very early in life or that Negroes on the average are not equal to whites in native ability.

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[15] Beckham, A. S., "A Study of the Intelligence of Colored Adolescents of Different Socio-Economic Status in Typical Metropolitan Areas," *Journal of Social Psychology,* Vol. IV (1933), pp. 70–91.

It is interesting to note that, in 1923, Clark[17] studied 500 Negro children in the public schools of Los Angeles and found the colored to be slightly superior to the whites (the median I.Q. was 103.7 for the former and 100 for the latter). Clark considers these results representative of the Negro elementary population of Los Angeles. It is impossible to understand why these results are so atypical. Can it be that at the time of this study, at least, Negroes in Los Angeles were not in the lower socioeconomic groups?

Education and age are two other factors which have to be equated in order to make a fair comparison of Negroes and whites. Peterson,[18] in some of his studies, chose all of his subjects at age twelve. This avoided the common difficulty encountered in comparing Negroes and whites on the basis of school grades, in which the Negroes are generally a year or more older than the whites. Miss Murdock[19] selected 230 Negro children from the public schools of New York City and compared them with 500 white children from corresponding grades. While school training was held constant, social status was not equated. She found that only about one-fourth of the Negroes did as well as the average white child.

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[16] McGraw, M.B., "A Comparative Study of a Group of Southern White and Negro Infants," *Genetic Psychology Monographs,* No. 10 (1931).

[17] Clark, W. W., "Los Angeles Negro Children," *Educational Research Bulletin,* Los Angeles City Schools (1923).

[18] Peterson, J., and Lanier, L. H., "Studies in the Comparative Abilities of Whites and Negroes," *Mental Measurements Monographs,* No. 5 (1929).

In most of the studies of Negroes conducted in the South, school grades do not form a fair basis for comparing the effects of school training. As Reuter[20] has pointed out, the length of the school year there varies greatly for whites and Negroes. The following data, published in 1927, show that in seven Southern states the Negro gets only about two thirds as much schooling as a white child. He also attends only about two thirds of the time that school is in session. Furthermore, it must be remembered that the teachers are not nearly so well trained and that there are fewer textbooks and much poorer school equipment for Negroes. It is therefore impossible to compare school grades for the two races in the South directly.

TABLE XIV

LENGTH OF SCHOOL YEAR IN SEVEN SOUTHERN STATES

| *State* | *White Schools* | *Negro Schools* |
|---|---|---|
| Alabama | 132 | 102 |
| Florida | 142 | 102 |
| Georgia | 157 | 100 |
| Kentucky | 152 | 119 |
| Louisiana | 156 | 94 |
| South Carolina | 156 | 78 |

Northern Negroes consistently score higher than Southern Negroes. The median scores on Army Alpha were, for the Northern Negro draft, 39, and for the Southern Negro draft, 12. (The white draft scored 76.) Other studies have given similar results. Two factors have often been suggested to account for these differences: first, the possibility that the more alert Negroes tend to migrate to the North, and second, that Negroes born in the North get a better school training. Common observation amply supports the second group of causes, but selective migration, in spite of its appealing plausibility, has not been supported by recent researches conducted by Klineberg.

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[19] Murdock, K., "A Study of Race Differences in New York City," *School and Society,* Vol. XI (1920), pp. 147–150.

[20] Reuter, E. B., *The American Race Problem: A Study of the Negro,* New York, Crowell, 1927.

**Race Mixtures.** Several attempts have been made to find out whether Negroes with some white blood are more intelligent than full-blooded Negroes. Ferguson[21] separated the men of eight Negro companies (1,132 men) into two groups of light and dark. The median Army Alpha scores for the darker Negroes was 40 and for the lighter Negroes 51. Another group of 1,156 was divided into three divisions designated as black, brown, and yellow. The black group had a median Army Alpha score of 39 and were 75 per cent illiterate. The brown group had a median score of 45 and were 23 per cent illiterate. The yellow group had a median score of 59 and were 5 per cent illiterate. These results seem to indicate that the whiter the Negro (presumably the more white blood he has), the more intelligent he is. Herskovits,[22] however, in a study of 539 students at Howard University, found practically no relation between color of skin and intelligence.

**Special mental abilities.** Many attempts have been made to discover whether there are important race differences in specific mental functions. Klineberg,[23] for example, found that Negroes were especially poor on speed tests. He believes that this accounts for a large part of their poor test scores on ordinary intelligence tests. Pintner and Keller[24] also used a nonlanguage test with Negroes, and Goodenough[25] used a picture-drawing intelligence test with another group. Suffice it to say that, as a rule, Negroes do not do as well as whites on such tests but do relatively better than on tests with large language elements.

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[21] Ferguson, G. O., "The Intelligence of Negroes at Camp Lee, Virginia," *School and Society,* Vol. IX (1919), pp. 721–726.

[22] Herskovits, *op. cit.*

**Educational achievements of Negroes.** In 1913 Mayo[26] made a study of Negro pupils in the high schools of New York City. He found the Negroes to be about three fourths as efficient as the whites, twenty-nine per cent of them equalling or surpassing the average for the latter. The Negroes were older than the white children and probably represented a much higher selection among their race. Table XV[27] gives the percentage of over-ageness in Negro children for three sections of the country which are neither distinctly Northern nor Southern: Not only are Negro children over-age, but they also do not do as well in school subjects, as attested by the following data,[28] which are probably typical:

Summarizing these and other data, Wilkerson[29] says:

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[23] Klineberg, Otto, "Racial Differences in Speed and Accuracy," *Journal of Abnormal and Social Psychology,* Vol. XXII (1927), pp. 273–277.

[24] Pintner, R., and Keller, R., "Intelligence Tests of Foreign Children," *Journal of Educational Psychology,* Vol. XIII (1922), pp. 214–222.

[25] Goodenough, Florence, "Racial Differences in the Intelligence of School Children," *Journal of Experimental Psychology,* Vol. IX (1926), pp. 388–397.

[26] Mayo, M. J., "The Mental Capacity of the American Negro," *Archives of Psychology,* No. 24 (1913).

[27] Data taken from the *Journal of Negro Education,* Washington, D. C., Howard University Press, July 1934.

[28] *Ibid.,* p. 464.

[29] Wilkerson, D. A., "Racial Differences in Scholastic Achievement," *Journal of Negro Education,* Vol. III (1934), pp. 453–478.

TABLE XV

PERCENTAGE OF OVERAGENESS FOR WHITE AND NEGRO CHILDREN IN THE ELEMENTARY AND HIGH-SCHOOL GRADES OF THREE SOUTHERN SCHOOL SYSTEMS

| Grade | *Percentage of Overageness for Negro Children* | | | *Excess of Negro Percentage over White* | | |
|---|---|---|---|---|---|---|
| | *Baltimore, Maryland (1920–1921)* | *Virginia (1925–1926)* | *West Virginia (1927–1928)* | *Baltimore, Maryland (1920–1921)* | *Virginia (1925–1926)* | *West Virginia (1927–1928)* |
| I | 45 | 57 | 51 | 22 | 21 | 23 |
| II | 63 | 71 | 42 | 28 | 29 | 8 |
| III | 70 | 75 | 83 | 28 | 28 | 22 |
| IV | 73 | 76 | 71 | 23 | 23 | 4 |
| V | 67 | 78 | 74 | 16 | 26 | 13 |
| VI | 60 | 77 | 77 | 18 | 29 | 8 |
| VII | 55 | 55 | 77 | 20 | 16 | 19 |
| VIII | 42 | 41 | 85 | 13 | 14 | 17 |
| IX | 37 | 35 | 75 | 15 | 14 | 28 |
| X | 40 | 23 | 72 | 24 | 5 | 24 |
| XI | 22 | 21 | 78 | 8 | 5 | 28 |
| XII | 28 | 7 | 50 | 14 | 4 | 8 |
| Average: | | | | | | |
| I–VIII | .. | .. | .. | 21 | 23 | .. |
| IX–XII | .. | .. | .. | 15 | 7 | 20 |

"The disparity between scores of Negro and white children and standard achievement tests is, in general, greater than on standard tests of intelligence."

One recent significant study raises serious questions about much of the earlier work with tests. Jenkins[30] has found that, in the schools of Chicago which he studied,

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[30] Jenkins, M. D., *A Socio-Psychological Study of Negro Children of Superior Intelligence*, unpublished doctor thesis, Deering Library, Northwestern University, 1935.

TABLE XVI

Relative Achievement in Various Subjects of Negro and White High-School Students in West Virginia (1927–1928)

| *Subject* | *Examination* | *Grade* | *Median Score* | | *Ratio of Negro Percentage To White* |
|---|---|---|---|---|---|
| | | | *White* | *Negro* | |
| English: Literature and grammar | Iowa High-School Content | XII | 41 | 34 | 83 |
| Mathematics | Iowa High-School Content | XII | 20 | 18 | 90 |
| Science | Iowa High-School Content | XII | 31 | 28 | 90 |
| History and social science | Iowa High-School Content | XII | 45 | 41 | 91 |
| Total score | Iowa High-School Content | XII | 137 | 121 | 88 |
| History | Pressey-Richards | XI | 47 | 39 | 83 |
| History | Pressey-Richards | X | 41 | 32 | 78 |
| Foods | King-Clark | XI | 37 | 38 | 103 |

there are approximately as many Negro children with high I.Q.'s as have been found in average white populations. In seven grade schools with a total Negro population of about 8,400, he found the following high Binet I.Q.'s:

| | |
|---|---|
| 140 or above | .33% |
| 130 or above | .66% |
| 120 or above | 1.23% |

One child was found to have an I.Q. of about 200, which is as high as any ever attained by a white child. In educational achievement there were Negro children who were much above the average with a mean E.Q. (educational quotient) of 127.2 ± 10.2 and an A.Q. (accomplishment quotient) of 95.4 ± 6.9, but, like most superior white children, they were not up to what might be expected of such bright children.

There is one field of endeavor, however, in which the Negro has always made a good showing—namely, music. Both in popular opinion and in tests, Negroes have almost equaled or, in some cases, even excelled whites in musical ability. On the Seashore tests,[31] Negroes obtained the following scores:

TABLE XVII

SEASHORE MUSIC TEST SCORES

| | *Scores for Children in 5 Grades* | | *Scores for Children in 8 Grades* | | *Scores for Adults* | |
|---|---|---|---|---|---|---|
| | *Whites* | *Negroes* | *Whites* | *Negroes* | *Whites* | *Negroes* |
| Pitch | 66.5 | 69.4 | 76.7 | 72.5 | 81.0 | 74.9 |
| Intensity | 73.6 | 75.2 | 82.8 | 81.8 | 88.9 | 88.3 |
| Time | 64.2 | 64.0 | 71.0 | 68.2 | 78.3 | 72.6 |
| Rhythm | 64.8 | 66.3 | 70.0 | 71.8 | 74.5 | 74.8 |
| Tonal Memory | 50.0 | 44.8 | 64.6 | 53.8 | 74.0 | 67.8 |

Those who hold that intelligence tests are a fair measure of the native ability of Negroes are able to make much of the argument that socio-economic status and education should make as much difference on music tests as on intelligence tests. Possibly this is true. However, since the Seashore tests purport to measure relatively simple mental functions, they may not be so much affected by environmental influences as are intelligence tests. Whatever the explanation may be, the fact remains that the Negro is superior to whites in musical ability, as measured by the Seashore tests. Not only in test scores, but also in musical performance, the Negro rates high in this field. The Fisk University Negro singers have for a long time held a high place in the musical world. Individual singers, such as Paul Robeson and Marian Anderson, rank with the best soloists in the country.

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[31] Johnson, Guy B., "A Summary of Negro Scores on the Seashore Music Talent Tests," *Journal of Comparative Psychology*, Vol. XI (1930), pp. 383–393. Also Garth, *op. cit.*, pp. 150–151.

In athletic contests the Negro has held his place with other racial groups. Jack Johnson and Joe Louis have upheld the honor of their race as prize fighters. In track and football the names of Ward, Owens, Simpson, Metcalf, and Johnson stand out among a host of less prominent Negro athletes. Probably there are not as many great Negro athletes as their race should produce in comparison with their numbers, but it must be remembered that in all except Negro colleges a Negro has to be outstanding to be placed on a team.

### The Indian

After whites and Negroes, the Indian has been the subject of more studies than any other race or nationality in the United States. In some respects the comparative intelligence of the Indian presents less difficulty than the Negro, while in other respects it presents more. The Indian is much less numerous than the Negro, there being about 350,000 Indians in this country. It is therefore possible to get more representative groups for testing. Indians are also probably even more homogenous than Negroes. They do, however, often have a language difference, which makes testing difficult.

The chief work in testing Indians has been done by Garth and his students. Garth[32] tested 1,050 full-blooded Indians with the National intelligence test and obtained a median I.Q. of 68.±10. Most of the other studies have included both full-blooded and mixed-blooded Indians. A comparison was made between Indian students in public schools and those in government schools.[33] The public-school Indians were slightly superior to the government-school Indians. Whether this difference was due to the fact that the Indians attending the public schools had improved through association with white children, had received superior training in school, or were a superior group of Indians, is not apparent.

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[32] Garth, T. R., "The Intelligence of Full-Blood Indians," *Journal of Applied Psychology,* Vol. IX (1925), pp. 382–389.

An early study[34] of 715 Indian and part-Indian students at Haskell Institute and about 135 representative white children gave a correlation of .51 between the amount of white blood and scores on the Otis test. The results of this study were interpreted as indicating that race differences, either of intelligence or temperament, were the most probable casual factor involved. A more recent study has been made by Garth,[35] in which he compared full-blooded Indians with three-quarter and half-breed Indians. The median National intelligence test I.Q.'s were 77, 75, and 74, respectively. There was much overlapping of groups, and these differences are apparently not particularly significant. The correlation of .42 between the amount of white blood and I.Q. was due largely to the relatively high correlations for the younger children. When Garth observed that correlations were much reduced for sixth-, seventh-, and eighth-grade children, he concluded that education tends to reduce to a minimum, or even to nothing, the effect of the presence of Indian blood in the educated mixed-blood individual.

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[33] Garth, T. R., and Garrett, J. E., "A Comparative Study of the Intelligence of Indians in the Public or Common Schools," *School and Society,* Vol. XXVII (1928), pp. 178–184.

[34] Hunter, W. S., and Sommermier, E., "The Relation of Degree of Indian Blood to Scores on the Otis Intelligence Test," *Psychological Bulletin,* Vol. XVIII (1921), pp. 91–92.

[35] Garth, T. R., "The Intelligence of Mixed-Blood Indians," *Journal of Applied Psychology,* Vol. XI (1927), pp. 268–275.

Of course, it is impossible to determine how much of the Indian's inferiority is due to a language handicap and to different customs. The Indians generally live apart from the whites and have their own customs, which are even more different than those of Negroes. We cannot estimate what effect it would have upon the relative scores of whites and Indians if the questions on the test used dealt largely with outdoor life, hunting, and certain acts of skill in these fields of endeavor. All we can say is that, when measured by white standards, Indians score on the average only about three fourths as high as whites. One study[36] was made with Indians, using the Pintner-Paterson performance scale and the Pintner nonlanguage test. The I.Q.'s obtained by this method were 92 and 97, respectively. This was in marked contrast with I.Q.'s of these same children, which were 78 and 80 when the Pintner-Cunningham and the National intelligence tests were used. This seems to indicate that the usual large differences on tests are at least partly due to a language handicap.

## The Chinese and Japanese

One other race, the yellow race, has received considerable study in this country. Most of these studies have been conducted along the Pacific Coast, where the largest numbers of this race are to be found. Tables XVIII and XIX, after Pintner, give a summary of the results of various intelligence tests:

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[36] Jamieson, E., and Sandiford, P., "The Mental Capacity of Southern Ontario Indians," *Journal of Educational Psychology,* Vol. XIX (1928), pp. 313–328.

## TABLE XVIII

### Tests of Chinese

| *Author* | *Number Tested* | *Test Used* | *Results* |
|---|---|---|---|
| Pyle and Creighton | 500 | Various psychological tests | Chinese excel in memory |
| Young | 109 | Binet | I.Q. 97 (children) |
| Symonds | 513 | Pintner | I.Q. 99 |
| Murdock | 23 | National | 50% overlapping |
| Murdock | 61 | Beta | |
| Sandiford and Kerr | 224 | Pintner-Paterson | I.Q. 107 (children) |
| Wang | 34 | Ohio State University Test | Chinese have language defect (adults) |
| Graham | 62 | Binet | I.Q. 87 (children) |
| Graham | 73 | Binet | I.Q. 91 (children) |
| Porteus and Babcock | 212 | Binet | I.Q. 87 |

## TABLE XIX

### Tests of Japanese

| *Author* | *Number Tested* | *Test Used* | *Results* |
|---|---|---|---|
| Fukuda | 43 | Binet | I.Q. 98 (children) |
| Murdock | 23 | National | 50% overlapping |
| Murdock | 61 | Beta | |
| Darsie | 658 | Binet | I.Q. 90 (children) |
| Sandiford and Kerr | 76 | Pintner-Paterson | I.Q. 114 (children) |
| Porteus and Babcock | 229 | Binet | I.Q. 85 |

From these data, it is very evident that the Chinese and Japanese who have been tested in this country closely resemble American norms for whites. They made such scores in spite of certain language handicaps and differences in customs and social background. While most of the Chinese and Japanese tested spoke English, they also spoke their own languages. It is generally believed that bilingualists do not make as good a score on intelligence tests in either language as those who command but one language.

## European Subraces

Klineberg[37] made a comparison of the Nordic, Alpine, and Mediterranean branches of the white race. He gave six tests from the Pintner-Paterson performance scale to representative groups of German, French, and Italian boys between the ages of ten and twelve years. He tested a German Nordic, a German Alpine, a French Nordic, a French Alpine, a French Mediterranean, an Italian Alpine, and an Italian Mediterranean group. These groups were all in rural communities, where the types were purest and where there was the least intermixture of types. He also tested groups of boys in Hamburg, Paris, and Rome. One hundred tests were given in each group. Table XX gives a summary of the results:

TABLE XX

Test Scores of Three European Subraces

| *Subrace* | *Median Score* | *Sigma* |
|---|---|---|
| German Nordic | 197.6 | 49.0 |
| German Alpine | 199.0 | 48.0 |
| French Mediterranean | 204.4 | 45.6 |
| French Alpine | 186.3 | 48.4 |
| French Nordic | 183.3 | 56.4 |
| Italian Alpine | 186.3 | 48.4 |
| Italian Mediterranean | 172.7 | 54.2 |
| Natives of Hamburg, Germany | 218.3 | 45.6 |
| Natives of Paris, France | 218.9 | 46.2 |
| Natives of Rome, Italy | 211.8 | 42.6 |

Klineberg[38] summarizes his findings in the following words: "These results indicate a definite, consistent and statistically reliable superiority of the city over the country groups. The differences among the three racial groups are small and unreliable. There are in addition marked variations between samples of the same race. The German Nordic group is a particularly good one, but the French Nordic is among the poorest. The Italian Mediterranean makes the lowest score, but the French Mediterranean has the best median score of all. This makes it impossible to attach any real significance to the concept of race as an explanation of the observed differences. *The results offer no support to the theory of a definite racial hierarchy.*"[39]

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[37] Klineberg, Otto, "A Study of Psychological Differences Between 'Racial' and National Groups in Europe," *Archives of Psychology,* No. 132 (1931).

[38] Klineberg, *op. cit.,* p. 194.

## The Jew

As already stated, the Jew does not belong to a separate race, despite the fact that most people speak of the "Jewish race." While Jews as a group have not intermarried with other branches of the white race, they have mingled with the other nationality groups in schools and in industry. In some places the Jew has retained his own language, but in most parts of this country he has also learned English. In large sections of the country, the younger generation of Jews has retained neither the Hebrew language nor Yiddish, knowing no language other than English. The language handicap is therefore not as serious in testing the Jew as with most of the other groups studied.

No less than a dozen studies have attacked the problems of the relative intelligence of the Jew. More than 6,000 Jews have been tested in these studies and, of course, many thousands more have been tested in the routine testing programs of schools and colleges. The results show rather conclusively that the Jew is neither significantly higher nor lower than other members of the white race speaking the English language in this country. His average I.Q. in these tests has been about 100.

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[39] Italics are ours.

## Nationality Groups

Several new problems arise in connection with the study of nationality groups, and some of the difficulties encountered with the various races within this country are even more troublesome.

First, there is always the question of sampling the groups tested. This is greatly complicated by the fact that we do not know, for example, how representative the immigrants from another country, such as Italy, are of its population in general. It would be much safer to confine the discussion of nationality differences to those within a given country. However, the broader applications are more interesting and are very apt to be made.

The language handicap of non-English-speaking nationality groups raises a difficult problem. With those members of other groups who have not been sufficiently absorbed into American traditions to eliminate the language difficulty, about the only satisfactory method of comparing the groups is by performance tests. At first thought it would seem possible to use a comparable form of the same tests in the language of the group being tested, but this method presents grave difficulties. It is not merely a problem of translation; there are other difficulties. For example, the Binet tests contain a list of 100 words to be defined. These are English words of common usage. The equivalent word in another language, because of economic and social differences, may be almost unknown. Thus the word "orange," the first in the list, might be almost unknown to children in some groups. Again, problems incurring money present difficulty. Withal, it is next to impossible to be certain that two tests using different languages are equivalent in difficulty. The best that can be done is to present the data available with the understanding that it represents in a fair measure the mental status of the person tested only when there is no serious language handicap or where performance tests are used.

**The Italian.** More Italians have been tested than any other white foreign language group in America. Table XXI[40] presents a summary of the results of an extensive series of tests:

### TABLE XXI

### Tests of Italian and American Children in This Country

| *Author and Year* | *Italians* | | *Americans* | | *Test Used* | *Other Intelligence Ratings* |
|---|---|---|---|---|---|---|
| | *I.Q.* | *Number Tested* | *I.Q.* | *Number Tested* | | |
| Arlitt (21) | 85 | 87 | 106 | 191 | Binet | |
| Pintner and Keller (22) | 84 | 313 | 95 | 249 | Binet | |
| Brown (22) | 78 | 51 | ... | ..... | Binet | |
| Young (22) | 88 | 248 | 107 | 402 | Army Alpha | |
| | 96 | 246 | 109 | 393 | Army Beta | |
| Pintner (23) | ... | 102 | ... | 121 | National | Italians overlap 36% |
| | ... | 102 | ... | 121 | Pintner nonlanguage | Italians overlap 43% |
| Colvin and Allen (23) | 91 | 50 | 92 | 50 | Binet | |
| | 76 | 50 | 85 | 50 | N.I.T. | |
| Bere (24) | 85 | 100 | ... | ..... | Binet | |
| Madsen (24) | 79 | 16 | ... | ..... | Binet | |
| Feingold (24) | 97 | 206 | 103 | 892 | Modified Army Alpha | |
| | 100 | 29 | 107 | 286 | Modified Army Alpha | |
| | 96 | 16 | 100 | 264 | Modified Army Alpha | |
| Pintner (24) | ... | 218 | ... | 653 | Pintner nonlanguage | $\frac{\text{Difference}}{\text{P.E. difference}} = 4.9$ |
| Graham (25–26) | 85 | 42 | 99 | 59 | Binet | Clinical cases |
| Kirkpatrick (26) | 83 | 96 | 104 | 94 | Illinois | Italians overlap 11% |
| | ... | 96 | ... | 1,030 | Army Beta | Italians overlap 19% |
| Hirsch (26) | 86 | 350 | 98 | 500 | Pintner-Cunningham and Dearborn | |
| Goodenough (26) | 89 | 456 | 101.5 | 106 | Goodenough | |
| Mead (27) | ... | 276 | ... | 8,130 | Otis | Italians overlap 7% |
| Rigg (28) | 91 | 140 | 105 | ..... | N.I.T. | |
| Kempf and Collins (29) | 87 | 31 | 107 | ..... | Binet | |
| Wheeler | ... | ... | ... | ..... | Dearborn | 1 to 2 1/2 years retarded |

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[40] Data taken from Pintner, R., *Intelligence Testing,* New York, Holt, 1931, p. 450.

In the language tests, such as Army Alpha and the Binet tests, the Italian average I.Q. is from 80 to 90. In the performance tests, such as Army Beta and the Goodenough picture test, it seems to range from 90 to 100.

**The Mexican.** Garth[41] and his students have given many group tests to Mexicans in our Southwestern states. Others have used performance tests. The scores in all cases have been below normal, the average I.Q. ranging from 80 to 90 in most of the studies. Boder[42] translated the Binet tests into Spanish and gave the tests to high-school students in Mexico City. As far as he was able to determine, the I.Q.'s averaged near 100. The selective factor there was no doubt much greater than in high schools in the United States. This may have accounted for the relatively higher rating for Mexicans in Mexico than for Mexican immigrants in the United States.

**Other nationality groups.** Several other nationality groups have been tested. Feingold,[43] for example, gave a form of Army Alpha test to a relatively large group of college students of English, Scotch, German, Danish, Swedish, French, Irish, Polish, and other extractions. The I.Q. of these groups ranged from 92 to 109. Hirsch[44] also tested several different nationality groups. Pintner[45] gave a series of performance tests to German, Slavic, and Hungarian children in their native countries. Table XXII, after Pintner, gives a summary of these and other similar studies:

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[41] Garth, T. R., "A Comparison of the Intelligence of Mexican and Mixed- and Full-Blood Indian Children," *Psychological Review,* Vol. XXX (1923), pp. 388–401.

[42] Boder, David P., *et al., La Escala Binet-Simon-Terman, para Mexico,* federal government publication, Mexico City, 1925.

[43] Feingold, G. A., "Intelligence of the First Generation of Immigrant Groups," *Journal of Educational Psychology,* Vol. XV (1924), pp. 65–82.

[44] Hirsch, N. D., "A Study of Natio-Racial Mental Differences," *General Psychology Monographs,* Vol. 1 (1926).

[45] Pintner, R., "Non-Language Tests in Foreign Countries," *School and Society,* Vol. XXVI (1927), pp. 374–376.

## TABLE XXII

### TESTS OF VARIOUS NATIONALITY GROUPS

| *Nationality* | *Author* | *Test Used* | *Number Tested* | *Average I.Q.* |
|---|---|---|---|---|
| Irish | Feingold | Modified Army Alpha | 44–278 | 97–100 |
| | Hirsch | Pintner-Cunningham and Dearborn | 214 | 96 |
| German | Pintner | Pintner nonlanguage | 161 | About 100 |
| | Hirsch | Pintner-Cunningham and Dearborn | 190 | 98.5 |
| | Rigg | National | 1,095 | 105 |
| Swedish | Brown | Binet | 187 | 102 |
| | Feingold | Modified Army Alpha | 28–114 | 98–102 |
| | Hirsch | Pintner-Cunningham and Dearborn | 236 | 102 |
| Bohemian | Bere | Binet | 100 | 93 |
| | Rigg | N. I. T. | 118 | 104 |
| Slavic | Pintner and Keller | Binet | 130 | 85 |
| Polish | Feingold | Modified Army Alpha | 11–90 | 92–100 |
| | Hirsch | Pintner-Cunningham and Dearborn | 227 | 90 |
| Lithuanian | Hirsch | Pintner-Cunningham and Dearborn | 468 | 97 |
| Finnish | Brown | Binet | 226 | 90 |
| | Kirkpatrick | Illinois | 147 | 100 |
| Hungarian | Pintner and Keller | Binet | 99 | 89 |
| Portuguese | Young | Various | 175 | 84–95 |
| | Hirsch | Pintner-Cunningham and Dearborn | 671 | 83 |
| Greek | Hirsch | Pintner-Cunningham and Dearborn | 270 | 88 |
| Armenian | Goodenough | Goodenough | 123 | 92 |
| Hawaiian | Porteus and Babcock | Modified Binet | 105 | 85 |

Men of various nationalities in the American army were classified, and Table XXIII presents the scores in terms of average mental age and the percentage of high (A and B) and low (D, D–, and E) scores:

TABLE XXIII

ARMY ALPHA SCORES ON DIFFERENT RACIAL GROUPS IN UNITED STATES ARMY

| *Country* | *Average M. A. Score* | *Percentage of A and B Ratings* | *Percentage of D, D–, and E Ratings* |
|---|---|---|---|
| England | 14.87 | 19.7 | 8.7 |
| Scotland | 14.34 | 13.0 | 13.6 |
| Holland | 14.32 | 10.7 | 9.2 |
| Canada | 13.66 | 10.5 | 19.5 |
| Germany | 13.88 | 8.3 | 15.0 |
| Denmark | 13.69 | 5.4 | 13.4 |
| Sweden | 13.30 | 4.3 | 19.4 |
| Norway | 12.98 | 4.1 | 25.6 |
| Ireland | 12.32 | 4.1 | 39.4 |
| Belgium | 12.79 | 0.8 | 24.0 |
| Turkey | 12.02 | 3.4 | 42.0 |
| Austria | 12.27 | 3.4 | 37.5 |
| Russia | 11.34 | 2.7 | 60.4 |
| Greece | 11.90 | 2.1 | 43.6 |
| Italy | 11.01 | 0.8 | 63.4 |
| Poland | 10.74 | 0.5 | 69.9 |

We can see at a glance from the last two tables that there is little or no mental inferiority in most of the nationality groups in which the language handicap is not great. Those nationalities with the lowest I.Q.'s are the Hawaiians, Filipinos, Polish, Greek, Russian, Portuguese, and French Canadians. While a language handicap and differences in customs and ideals no doubt account in part for the lower scores of these groups, it seems likely that the majority of those in this country are deservedly below the norms for the country at large. The practice during the Army testing was to give Army Beta (a performance test) to all illiterates and to equate the Beta scores with the former. This at least partly eliminated the language handicap.

Probably the contention of Brigham,[46] who, especially in his earlier writings, believed in wide racial and national differences, and that of Boas, who believes that each race is best fitted for its own environment and that there are few or no real race differences, are both wrong. They represent extreme points of view concerning race differences. It should, however, be noted that there are so many ways of explaining the presence of differences in test results between racial groups that one does not feel obliged to use racial inheritance as an explanation of so-called race differences. On the other hand, the presence of many cultural and educational differences between races does not entirely rule out the possibility of true race differences.

### Exercises

1. Give a rigid definition of *race* and show how the concept of race thus defined is hard to use in studies of race differences.

2. Distinguish between: (*a*) race and nation; and (*b*) race and language group.

3. If a large group of people having for the most part a common remote ancestry possess similar mental traits, what possibilities, other than inheritance, may be used to explain the similarities obtaining among them?

4. Give several examples of a language group composed of diverse racial groups.

5. Select some nation and estimate the proportion of the population belonging to a single racial group. How is the proportion dependent upon the definition of race?

6. What is the objection to saying that differences in group attitudes are racial in character?

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[46] Brigham, C. C., *A Study of American Intelligence,* Princeton, New York, Princeton University Press, 1923.

7. What are some of the reasons for not accepting at face value the racial differences found in studies using "general intelligence" test results? Limit your answers: (*a*) to weaknesses inherent in the tests themselves and in testing methods; and (*b*) to difficulties in getting representative samples of races.

8. Discuss the possibility that differences in physique between Negroes and whites have any bearing on psychological differences between these races.

9. Point out the difficulties of comparing: (*a*) sixth-grade Negro and white children; and (*b*) eleven-year-old children of each race. Would sixth-grade eleven-year-olds represent the same type of selection from each race?

10. What, if any, would be the objections to making a study of race differences of Negroes and whites by taking large groups of dentists from each race as subjects?

11. To what can the often observed average three-year difference in mental age between Negroes and whites be attributed?

12. What is the explanation of a near zero correlation between Negro physical characteristics and test scores? Does the environment of Negroes vary with pigmentation of the skin, width of the nose, or thickness of the lips?

13. Klineberg found a positive relationship between length of residence in New York and I.Q. of ten-year-old Negro children. How is this finding related to the hypothesis that Northern Negroes score higher than Southern Negroes because the more intelligent have moved north?

14. What is the fallacy in saying that Negro scores in mathematics or science were ninety per cent as high as those for whites? Does this statement imply that a zero score on a science test indicates utterly no knowledge of science? How is the use of arbitrary zeros in subject-matter tests related to this question?

15. Comment upon this statement: "The fact that the highest I.Q.'s ever observed among Negroes are quite as high as the highest observed among whites is more significant in indicating the inherited potentialities of Negroes than are the averages of hundreds of I.Q.'s from many studies of Negroes and whites."

16. Garth found that the Indians whom he studied had a median I.Q. of 68. Determine, if possible, or suggest reasons for reporting the median I.Q. rather than the mean I.Q.

17. Name as many factors as possible, aside from language difficulty, to explain the relatively low I.Q.'s of Indians.

18. What were the reasons for Italian migration to America before 1914? What occupations did they enter here? Are these facts related to their relatively low mental test ratings?

19. What is meant in the table of data on Italians and Americans by saying that the Italians showed an overlapping: of (*a*) thirty-six per cent; and (*b*) forty-three per cent? What would have been their status if they had shown an overlap of fifty per cent?

20. To what extent do you care to accept observed mental test differences between racial and national groups? Allowing for errors of measurement in tests, how much of the net difference between racial groups do you suppose is a true—that is, inherited—race difference?

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## CHAPTER VII

# The Influence of Near Ancestry

### Factors in Family Relationships

In our discussion of race differences, the similarities between the inheritance of the members of the same race were mentioned. One author[1] has made a strong claim that the similarities within any race or among races are entirely due to similarities within the chromosomes. People are more and more alike as there are greater likenesses in their chromosomes. This is certainly true of physical characteristics and partly true of mental characteristics. Since mental qualities are so greatly modified by training, as has already been pointed out, many of the similarities that we find among people closely associated together are due to common experiences, social conditions, and education.

Both hereditary and environmental influences are more alike the closer the relationship between people. The greatest possible likeness is to be found in identical twins, where, theoretically at least, the chromosomes in each are identical and, as a rule, the environmental influences are very similar. There is a close relationship between siblings, but their physical similarity is only about half as great as that of identical twins. Galton[2] was the first to point out the general relationship between siblings and between parents and offspring. According to his theory of ancestral inheritance, a child receives 50 per cent of his inheritance from his parents. The other half of his inheritance comes from his earlier ancestors: 25 per cent from his grandparents (6¼ per cent from each), 12½ per cent from his great grandparents (1 9/16 per cent from each), and the remaining 12½ per cent from his more remote ancestors.

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[1] Jennings, H. S., *The Biological Basis of Human Behavior,* New York, Norton, 1930.

The way in which inheritance takes place was explained in Chapter II. Inheritance is carried by the chromosomes, or, to be more exact, by the genes of which the chromosomes are composed. In identical twins, the first cell made up of chromosomes from each parent completely divides. The composition of the chromosomes of each resulting offspring is identical. In siblings, by chance the composition of the chromosomes are half alike. We cannot predict in any particular trait whether siblings will be alike or different; only when large numbers of traits are considered will they be found to be half alike and half different.

Although a child receives all his inheritance from his parents, these parents carry factors which are not apparent. Only about half the traits possessed by the child are exhibited by the parents, since the other half of his inheritance comes from his earlier ancestors. In understanding these facts, we must keep in mind that any unit trait is dependent upon the action of two genes, one from each of two chromosomes. The nature of any trait depends upon the combination of two genes, one from each parent. Then, as has been pointed out so many times, there are also the environmental factors which may produce likenesses or differences. Let us now review the important studies of the influence of these two factors—heredity and environment—on likenesses and differences among near ancestors.

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[2] Galton, Francis, *Natural Inheritance,* New York, Macmillan, 1889.

### Studies of Family Inheritance

**Galton's study of eminent Englishmen.** The first significant study of family inheritance was conducted by Sir Francis Galton.[3] Galton, himself a member of a notable family and cousin of Charles Darwin, was convinced that genius was inherited. This he set out to prove. He studied the family histories of 977 eminent Englishmen. His subjects included judges of England from 1660 to 1868, statesmen of the time of George III; premiers for the last hundred years; illustrious commanders; men of literature and science; poets, painters, and musicians; divines and modern scholars; and, for physical traits, a small group of prominent oarsmen and wrestlers. The men whom Galton chose were estimated to be the most eminent in 4,000—that is, he chose the most illustrious 250 persons out of each million of the population. Whatever errors he may have made in his selection of subjects, there is no question about their being illustrious. They were as carefully chosen as possible, when considered in the light of the means available for selection.

Taking the most eminent member of each family group as a point of reference, Galton found that these men had 89 fathers, 114 brothers, and 129 sons who were also eminent. In addition, they also had 52 grandfathers, 57 grandsons, 53 uncles, and 61 nephews belonging to the group. This made a list of 332 first-degree relatives and

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[3] Galton, Francis, *Hereditary Genius,* New York, Macmillan, 1892 (1925).

203 second-degree relatives in the group studied.[4] Galton estimated that 977 ordinary men would be expected to have each one eminent relative one degree removed and 3 such relatives two degrees removed. In other words, the eminent men had 131 times as many such relatives as could be expected in a normal selection. These differences Galton explains on the basis of inheritance. His extreme point of view is well expressed in the following quotation:[5]

> Everybody who has trained himself to physical exercise discovers the extent of his muscular powers to a nicety. When he begins to walk, to row, to use dumb bells, or to run, he finds to his great delight that his thews strengthen, and his endurance of fatigue increases day after day. So long as he is a novice, he perhaps flatters himself there is hardly an assignable limit to the education of his muscles; but the daily gain is soon discovered to diminish, and at last it vanishes altogether. His maximum performance becomes a rigidly determinate quantity. He learns to an inch how high or how far he can jump, when he has attained the highest state of training. He learns to a half pound, the force he can exert on the dynamometer, by compressing it. He can strike a blow against the machine used to measure impact and drive its index to a certain graduation, but no further. So it is in running, in rowing, in walking, and in every other form of physical exertion. There is a definite limit to the muscular powers of every man which he cannot by any education or exertion overpass.
>
> This is precisely analogous to the experience that every student has had of the working of his mental powers. The eager boy, when he first goes to school and confronts intellectual difficulties, is astonished at his progress. He glories in his newly developed mental grip and growing capacity for application, and, it may be, fondly believes it to be within his reach to become one of the heroes who have left their mark upon the history of the world. The years go by; he competes in the examinations of school and college over and

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[4] Siblings and parents are first-degree relatives; grandparents, uncles, and nephews are second-degree relatives.

[5] *Ibid.*, pp. 12–14.

> over again with his fellows, and soon finds his place among them. He knows he can beat such and such of his competitors: that there are some with whom he runs on equal terms, and others whose intellectual feats he cannot even approach.—Accordingly with newly furbished hopes, and with all the ambition of twenty-two years of age, he leaves his University and enters a larger field of competition. The same kind of experience awaits him here that he has already gone through.—When he reaches mature life he is confident only within certain limits, and knows, or ought to know, himself just as he is probably judged of by the world, with all his unmistakable weakness and all his undeniable strength.

All these differences Galton explains on the basis of innate capacities. This was opposed to the prevailing conception of his day, and Galton must be given credit for swinging popular opinion by extreme illustration in the direction of the significance of inheritance. It should also be said that, in some of his later writings, he admitted the importance of training to a certain extent. Finally, Galton's investigation must be recognized as a monumental study, which had a profound influence on later thinking and similar studies. Suffice it to say, however, that Galton did not divorce the effects of heredity and environment and that it is therefore not possible to evaluate the relative influence of each of these two factors. His only bit of evidence on this problem is the fact that, as he pointed out, adopted sons of popes did not attain the same degree of eminence as the real sons of other gifted men. This evidence is meager and inconclusive, and up to this point the problem still remains open for solution.

**Pearson's study of siblings.** The next important study of inheritance was by Karl Pearson, a student of Galton's. Pearson had teachers rate about 2,000 siblings on eight traits: ability, vivacity, conscientiousness, popularity, temper, introspection or self-consciousness, assertiveness, and handwriting. These traits were rated on a three-point scale, except for ability and handwriting, which were rated on a six-point scale. Table XXIV gives the results of these ratings:

TABLE XXIV

CORRELATION OF RATINGS OF SIBLINGS

| *Trait* | *Ratings* | | |
|---|---|---|---|
| | *Brothers* | *Sisters* | *Brothers and sisters* |
| Ability | .46 | .47 | .44 |
| Vivacity | .47 | .43 | .49 |
| Conscientiousness | .59 | .64 | .63 |
| Popularity | .50 | .57 | .49 |
| Temper | .51 | .49 | .51 |
| Introspection | .59 | .47 | .63 |
| Assertiveness | .53 | .44 | .52 |
| Handwriting | .53 | .56 | .48 |
| Average | .52 | .51 | .52 |

A study such as this suffers from two kinds of errors. First, the ratings are admittedly unreliable. The best estimates we have indicate that the average rating of two persons on traits like these probably will correlate at about .45 to .55. In other words, ordinary ratings are so unreliable that we cannot place much confidence in them. Because the unreliability of a measure reduces the size of the correlation, the true relationship of the above traits in siblings might be expected to be greater than these correlations show. Second, in his directions to teachers, Pearson states: "The object of this investigation is twofold: (1) to ascertain the degree of resemblance, mental and physical, between children of the same parents, (2) the measurements and estimates are to be made on (a) pairs of brothers, (b) pairs of sisters and (c) pairs of brothers and sisters." These directions very likely caused the teachers to select those to be rated and called attention to the *similarity* between them. These factors probably increased the similarities of the ratings and made them too high.[6] Whether the two sources of error, one in each direction, tended to compensate for each other we cannot be sure. It seems likely that they did. However, as already suggested, this study should be considered as an interesting early attempt to study a very difficult problem, although the results are not so conclusive.

**Woods' study of European royalty.** Another study of inheritance was made in 1906 by F. A. Woods,[7] who rated on the basis of a ten-point scale, 671 members of European royalty. Ratings on both intelligence and morality were based upon biographical and historical evidence, which meant, of course, that they were subject to the errors both of the historian in recording the facts and of Woods in his estimate of these records. The highest ranks were assigned to the families of Frederick the Great, Queen Isabella, and Gustavus Adolphus; the lowest ranks, to the ruling houses of Russia and Spain. Woods correlated the ranks of various relations and obtained the following correlations.

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[6] Galton also compared brothers, sisters, and brothers and sisters on such physical characteristics as stature, eye color, hair color, cephalic index, and health. The average correlations were: for brothers, .54; for sisters, .53; and for brothers and sisters, .51.

[7] Woods, F. A., *Mental and Moral Heredity in Royalty,* New York, Holt, 1906.

TABLE XXV

CORRELATION OF RATINGS OF OFFSPRING AND PARENTS

| *Trait* | *Ratings* | | |
|---|---|---|---|
| | *Offspring and fathers* | *Offspring and grandfathers* | *Offspring and great-grandfathers* |
| Intellect........ | .30 | .16 | .15 |
| Morals.......... | .30 | .175 | |

There are several factors which prevent these correlations from expressing a true relationship between the intellect of parents and offspring. Some of these factors tend to reduce the correlations and others to increase them. One of those that no doubt reduced the correlations was the unreliability of the rankings of the intelligence of the royalty in this study. Another cause for low correlations may be the relatively small range in the ratings for the large majority of those studied. An opposite effect on the correlations may be attributed to more than the usual amount of blood relationship between parents and offspring. As a result of inbreeding in the royal families of Europe, possibly Galton's law of ancestral inheritance would show too low a relationship between parents and offspring for the subjects of this study. It is difficult to weigh the relative importance of these different influences which affected the correlations obtained by Woods. At least we may guess that the influences which reduced the correlation were greater than those which increased them, since, as we shall see later, most correlations between parents and offspring are not far from .50.

Woods also made an attempt to contrast the effects of heredity and environment. He says:[8]

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[8] Woods, F. A., *Mental and Moral Heredity in Royalty,* New York, Holt, 1906, p. 286.

> There is one peculiar way in which a little more than half of all males have had a considerable advantage over the others in gaining distinction as important historical characters. The eldest sons, or if not the eldest, those sons to whom the succession has devolved, have undoubtedly had greater opportunities to become illustrious than those to whom the succession did not fall by right of primogeniture. I think every one must feel that perhaps much of the greatness of Frederick II, of Prussia, Gustavus Adolphus, and William the Silent, was due to their official position; but an actual mathematical count is entirely opposed to the view. The inheritors of the succession are no more plentiful in the higher grades than in the lower. The figures below show the number in each grade who came into power by inheriting the throne:

| Grades | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total number in each grade | 7 | 21 | 41 | 49 | 71 | 70 | 68 | 43 | 18 | 7 |
| Succession inheritors | 5 | 14 | 26 | 31 | 49 | 38 | 45 | 23 | 12 | 4 |
| Per cent | 71 | 67 | 63 | 64 | 69 | 54 | 67 | 54 | 67 | 57 |

> It is thus seen that from 54 to 71 per cent inherited the succession in the different grades. The upper grades are in no way composed of men whose opportunities were enhanced by virtue of this high position. Thus we see that a certain very decided difference in outward circumstances—namely, the right of succession—can be proved to have no effect on intellectual distinction, or at least so small as to be unmeasurable without much greater data. The younger sons have made neither a poorer nor a better showing."

In the case of the resemblances in morality, Woods is less emphatic in denying that any discount for similarity in training is required. In fact, his attitude on this question is not clear. This approach to the problem is interesting but not conclusive.

**Terman's studies of gifted children.** Terman,[9] in his studies of 1,000 gifted California children, investigated the family history of 643 of these children. He found that nearly one fourth of the members of the Hall of Fame are related to his group; five parents, four grandfathers, and thirty-five other near relatives appear in *Who's Who.* Among the ancestors of these children, six were signers of the Declaration of Independence, two were presidents and two vice presidents of the United States. Their number included also six authors, two ministers, four statesmen, three artists, two Supreme Court justices, four college presidents, twenty-three college professors, seventy-four major managers or superintendents, and eighteen bank presidents. One family had thirty-four known relations listed in Appleton's *Cyclopedia of American Biography* or in *Who's Who.*

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[9] Terman, L. M., *Genetic Studies of Genius,* Vol. I, Palo Alto, California, Stanford University Press, 1925.

These characteristics, Terman believes, are chiefly due to superior inheritance. No doubt part of them are. However, it must be remembered that almost any person of American stock of long standing and good educational advantages can claim many noted relatives. How much of this depends upon the genes and how much upon the training we cannot tell. These children were sons and daughters of superior parents. They also lived in superior homes and had unusual social and educational advantages. These advantages also certainly count in their present high attainments.

**Cattell's studies of American men of science.** In marked contrast to the point of view presented by the preceding writers is that of Cattell.[10] Although Cattell was a student of Galton's, he emphasized the importance of environment almost as strongly as Galton had emphasized heredity.

In keeping with some earlier studies on the European continent, Cattell, in 1903, selected 1,000 outstanding

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[10] Cattell, J. G. McK., "A Statistical Study of American Men of Science," *Science,* new series, Vol. XXIV (1906), pp. 732–742.

American men of science. He then determined the birthplace and place of residence of these men. He found that Massachusetts furnished 108.8 per million of population, Connecticut 86.9, Vermont 57.1, New York 47.2, Ohio 32.1, Illinois 24.5, Iowa 29.6, Wisconsin 45.1, and California 28.9. In 1932 he made a similar study[11] and found that the birth rate for distinguished scientists had dropped from 108.8 to 72 in Massachusetts and from 86.9 to 16 in Connecticut, whereas it had risen from 42 to 88 in Illinois, from 4 to 32 in Minnesota, and from 14 to 40 in Missouri.

Cattell raised the question as to whether these shifts were due to a difference in racial stock or principally to increased educational opportunities in the Middle Western states. The period when the scientists of the early thirties were receiving their university training was the period of the rise of the large universities of the Middle West. He believed this accounted for the principal changes in the relative proportion of men of science to the population in general.

The fact that such outstanding investigators have held such widely divergent views concerning the nature-nurture problem may indicate something about its difficulty. This also illustrates the fact that personal opinions and prejudice can hardly be eliminated from scientific investigations. Another great difficulty is the fact that the variables cannot be isolated and studied independently.

**Studies of canalboaters', Gypsy, and millworkers' children by Gordon and Jordan.** Something about how intelligence scores are influenced by social and educational factors is shown by at least two important studies, one made in England and one in this country. Gordon[12] gave the Binet tests to seventy-six children of the canalboat population of London. These children had received practically no formal schooling. Many of the parents could not read or write and little opportunity was provided for intellectual pursuits. Plenty of provision was made, however, for physical activity, so that, according to Gordon, these children were equal, if not superior, in health, cleanliness, and morality to those of town dwellers of similar social status. He found that the younger children, from four to six years old, had an average I.Q. of 90, whereas the older children, from twelve to twenty-two, had an I.Q. of only 60. Apparently a normal intellectual environment is necessary for normal mental growth. If such an environment is not present, the ordinary mental growth does not take place and the I.Q. decreases with age.

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[11] Cattell, J. G. McK., *American Men of Science,* fifth edition, New York, Science Press, 1933.

[12] Gordon, Hugh, *Mental and Scholastic Tests Among Retarded Children,* London Board of Education, Pamphlet No. 44 (1923).

A similar study by Gordon of a group of Gypsy children gave like results. They too had received little school training and their I.Q. had likewise decreased with age to about the same extent as that of the canalboaters' children.

Jordan[13] investigated more than 1,000 children in a Southern industrial area, as part of a larger study of the relative intelligence of children of different occupational groups. Nearly half of the thousand used in this part of the study were children of millworkers. These children had received little formal school training, lived mostly in rented houses, and moved about a great deal. Table XXVI gives the average I.Q., as obtained from one or the other of two group intelligence tests, for children from age 6 to 13. Corresponding age groups for other industrial groups with better educational advantages are given for comparison:

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[13] Jordan, A. M., "Occupations and Intelligence Scores," *Journal of Applied Psychology,* Vol. XVII (1933), pp. 103–119.

TABLE XXVI

Average I.Q. for Millworkers' and Nonmillworkers' Children

| *Age* | *Number Tested* | | *Average I.Q.* | |
|---|---|---|---|---|
| | *Millworkers' children* | *Non-millworkers' children* | *Millworkers' children* | *Non-millworkers' children* |
| 6 | 41 | 70 | 100 | 101 |
| 7 | 77 | 123 | 99 | 103 |
| 8 | 71 | 117 | 95 | 100 |
| 9 | 65 | 107 | 91 | 94 |
| 10 | 53 | 108 | 85 | 92 |
| 11 | 71 | 95 | 90 | 94 |
| 12 | 62 | 101 | 87 | 94 |
| 13 | 54 | 90 | 85 | 92 |

From these results, it can be seen that the I.Q. of millworkers' children decreased from 100 at age 6 to 85 at age 13. There was also a slight decrease for the children of nonmillworkers, but this was only half as great as that for the children of millworkers. This comparison group likewise represents children who did not have full intellectual opportunities.

The most reasonable explanation of the data of the canalboaters, Gypsy, and millworkers' children seems to be that the children of normal, healthy parents will obtain an I.Q. near 100 in their earlier years regardless of the social and economic status of the home. But as our tests are standardized, social and educational advantages, together with an intellectual environment, are necessary in order to retain a normal I.Q. in the higher ages. When such advantages are not forthcoming, the I.Q. declines.

These studies, as well as others to be reported later, certainly show that the I.Q. is in no small degree affected by the environment.

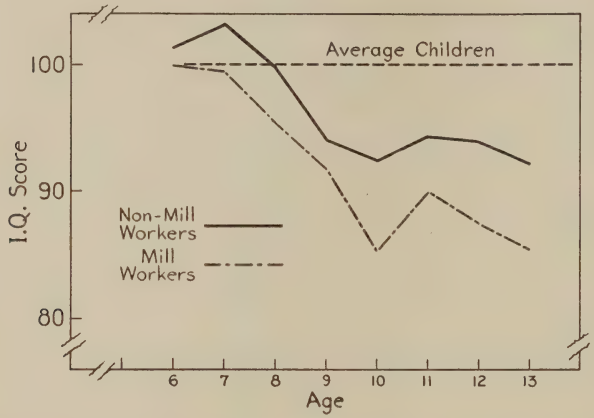

**Fig. 26.**—Age Changes in I.Q. of Millworkers' Children Compared with Nonmillworkers' Children.

## Studies of Mental Resemblances Between Parents and Children

Several studies already mentioned have compared parents and children or one child in a family with other children. But many of these studies did not use standardized tests as a basis of comparison. A few studies in which such tests were used should be mentioned.

One investigator[14] gave tests to about 141 children and 100 mothers and 90 fathers of these children. The average parent-child correlation was .35. On some tests, of course, the correlations were lower and on others higher than this average. Slightly higher correlations were found on verbal tests and those more dependent on intelligence and past experience. Several other studies[15] using the Binet and other intelligence tests have obtained correlations ranging from .27 to .63, with the average near .50. Similar correlations have also been found between pairs of siblings.

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[14] Willoughby, R. R., "Family Similarities in Mental Test Abilities," *Twenty-Seventh Yearbook,* National Society for the Study of Education (1928).

TABLE XXVII

FAMILY CORRELATIONS IN MENTAL ABILITY

| *Investigator* | *Number Tested* | | *Scale Used* | *Correlation* |
|---|---|---|---|---|
| | *Parents and children* | *Siblings* | | |
| Jones | 527 | .... | Binet and Army Alpha | .50–.55 |
| Gordon | ... | 182 | Binet | .53 |
| Hart | ... | 618 | Binet | .40–.46 |
| Hildreth | ... | 1,540 | Binet | .27–.63 |
| Thorndike | ... | 2,400 | I. E. R. | .60 |

## Studies of Foster Children

Two other studies bear directly on this problem of the effects of environment and heredity or near ancestry.

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[15] For studies by H. E. Jones, and E. L. Thorndike, see *Twenty-Seventh Yearbook,* National Society for the Study of Education, Bloomington, Illinois, Public School Publishing Company, 1928. For studies by other investigators, see Gordon, K., "Psychological Tests of Orphan Children," *Journal of Delinquency,* Vol. IV (1919), pp. 46–55; Hart, H., "Correlations between Intelligence Quotients of Siblings," *School and Society,* Vol. XX (1924), p. 382 ff.; and Hildreth, G. H., "Resemblance of Siblings in Intelligence and Achievement," *Columbia University Contributions to Education,* No. 186 (1925).

Freeman[16] in Chicago and Miss Burks[17] in California attacked the problem of the relationship in mental traits of children placed in foster homes. The problem and methods of the two investigators were similar. Let us briefly review each study.

**Freeman's study.** By means of the Stanford-Binet tests, Freeman and his associates tested 401 children who had been placed in foster homes. These children were orphaned or illegitimate and had been deserted or voluntarily placed with the Illinois Children's Home and Aid Society. Of this group, 134 had been given intelligence tests before or soon after their placement in foster homes. The first tests had not been made specifically in all cases as a basis of placement but for various other reasons, such as behavior difficulties or because the children had been suspected of being feeble-minded. Seventy-seven of them had been tested immediately before placement and again after placement, on the average eight years later. The mean I.Q. before placement was 91.2±1.05 and after placement 93.7±1.1. Freeman believes that the difference 2.5±.8 is not a fair measure of the effect of the new environment on these children. He argues that the Binet tests penalize older children and that the actual difference in I.Q. between these two testings should be about 7.5.

The homes into which these children were placed were rated on a home-rating blank. When the children placed in better homes were studied, it was found that they had gained on the average 5.3 points in intelligence. When this difference was corrected, as the other data had been, to allow for imperfections in the test, the difference was raised to 10.4 points. Additional evidence of the importance of the type of home into which the children were placed is furnished by the fact that the correlation between the home rating and intelligence of the child at the time of placement was .34 ± .07. After an interval of about four years in these homes, the correlation was raised to .52±.06. This shows that, while there is some relation between intelligence and the type of home into which the child is placed, this ratio is increased by residence in such homes.

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[16] Freeman, F. N., Holzinger, K. J., and Mitchell, B. C., "The Influence of Environment on the Intelligence, School Achievement, and Conduct of Foster Children," *Twenty-Seventh Yearbook,* National Society for the Study of Education (1928), pp. 103–217.

[17] Burks, Barbara S., "The Relative Influence of Nature and Nurture upon Mental Development," *Twenty-Seventh Yearbook,* National Society for the Study of Education (1928), pp. 219-316.

The children that were tested after placement in foster homes and those who changed from one foster home to another showed little gain in I.Q. over the first time they had been tested. This seems only what might be expected. The children who were tested after placement had averaged four and three quarter years in these homes before being tested, so that any changes that were going to take place had already taken place. Those who changed homes were older children, averaging ten years of age at the time of the first test. Therefore, they were not so susceptible to change as younger children might have been.

Freeman also studied 130 siblings who had been separated by adoption or placement in different homes for four or more years. In some cases there were more than two in a family, so that only sixty-four families were represented in this group. It included several illegitimate and fifteen colored children, and the average I.Q. was rather low (90.4). By a complicated statistical procedure, these siblings were compared with each other. According to one method (the double-entry method), the correlation between them was .25; by another (the contrasting age method), it was .34. These correlations are lower than those ordinarily obtained for siblings. That the age of separation is a factor in these correlations is shown by the fact that, for children who were separated after five years of age, the correlations were .43 and .49 by the respective methods; whereas for those who were separated before five years of age, the correlations were .25 and .32, respectively.

Comparisons were also made between foster children and children belonging to the family. Although there was no blood relationship between these children in forty pairings, there was a correlation of .34 between them.

A general summary of the relations of the intelligence of foster children to their parents is shown by the fact that, of 120 children with at least one parent mentally defective (I.Q. below .70), the average I.Q. of the children was 92.9. For those separated from their parents before five years of age, the average I.Q. was 95.1; for those separated after five years of age, it was 87.2. Only four of the 120 children of defective parents were defective. Of 26 cases in which both parents were defective, the average I.Q. was 81.2. This proves rather conclusively that feeble-mindedness, as measured by intelligence tests, is not a unit recessive trait in terms of Mendelian inheritance. If it were, all the offspring of two defective parents should have been defective, whereas only four of them were defective. Table XXVIII gives an indication of the effect of different types of homes on the I.Q.'s of foster children, as shown by a correlation of .48 between the child's intelligence and the foster home rating for the whole group of 401 children.

Of these 401 foster children, 348 either were in school or had recently been withdrawn. Of these, 75 per cent were in their normal school grade, 11 per cent were accelerated, and 20 per cent were retarded. Of those who had been placed in a foster home before six years of age, 75 per cent were normally placed in school, 14 per cent accelerated, and 11 per cent retarded. These placements in school show that the children were very similar to the averages for school children of four cities cited in the Gary survey,[18] in which 11 per cent were accelerated, 69 per cent normal, and 20 per cent retarded. This is true despite the fact that, as a group, these foster children were slightly below the median I.Q. for all school children.

TABLE XXVIII

Intelligence of Foster Children According to Grade of Home

| *Type of Home* | *Number Tested* | *Mean I.Q.* |
|---|---|---|
| Good (23–30) | 114 | 106.8 |
| Average (15–22) | 186 | 96.4 |
| Poor (6–14) | 101 | 88.9 |
| Average | | 97.5 |
| Sigma | | 15.9 |

It must be remembered that the parents of these foster children were in many cases morally defective. Of the children over nine years old, more than half had at least one morally defective parent. Despite this fact, only 23 (16 per cent) of the children of these morally defective parents were behavior-problem cases. Of a total of 268 cases of foster children, only 32 were behavior cases. This is not more than is to be found in the general school population. Certainly morality is not inherited.

**Burks' Study.** Miss Burks' study will be reviewed only briefly and largely in terms of how it differs from

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[18] Flexner, A., and Bachman, F. D., *The Gary Schools: General Account,* New York, Board of Education, 1918, p. 181.

Freeman's study. She tested only children of white, non-Jewish, English-speaking parents of American, British, or North European stock. The children were all placed in foster homes before twelve months of age and were between the ages of five and twelve years when tested. The cases studied numbered 204.

By means of a complicated statistical analysis, Miss Burks comes to the conclusion, with regard to the relative contribution of factors to the I.Q.: (1) that home environment contributes about 17 per cent of the variance, parental intelligence alone accounting for about 33 per cent; (2) that heredity accounts for probably between 75 and 80 per cent; (3) that the maximum contribution of the best home environment to intelligence is probably about 20 I.Q. points and that the poorest American home environment may depress the I.Q. as much as 20 points. In evaluating these results, it must be remembered that Miss Burks selected only white non-Jewish, English-speaking children. This restricts the range of her results and possibly accounts for the fact that she did not find as large a difference due to environment as Freeman.

Even these studies do not solve the problem of the relative influence of heredity and environment; however, they do throw some light on it. At least, they certainly show that the I.Q. is subject to environmental influences and they do give us more of a basis for a point of view than the numerous statements of opinion on the subject without any significant empirical evidence to back them.

## Studies of Twins

**Studies by Galton, Thorndike, and others.** Galton,[19] in his various studies of inheritance, became interested in the problems of twins. He collected data on thirty-five pairs of similar twins and twenty pairs of dissimilar twins. Galton's study was made before the time of intelligence tests, so that he had to rely upon a questionnaire method. He summarizes his results as follows: "The impressions that all this evidence leaves on the mind is one of some wonder whether nurture can do anything at all, beyond giving instruction, and professional training. . . . There is no escape from the conclusion that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly to be found among persons of the same rank of society, and in the same country." This quotation again shows Galton's great bias regarding the importance of heredity.

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[19] Galton, Francis, *Inquiries into the Human Faculty and its Development,* New York, Macmillan, 1883.

TABLE XXIX

Correlations Between Ratings in Physical and Mental Traits in 50 Pairs of Twins

| *Ratings in Physical Traits* | | *Ratings in Mental Traits* | | | |
|---|---|---|---|---|---|
| | | *Test Used* | *Ages 9 to 11* | *Ages 12 to 14* | *All ages* |
| Cephalic index | .76 | Crossing out a's | .66 | .73 | .69 |
| Sitting height/standing height | .76 | Crossing out a-t's and r-c's | .81 | .62 | .71 |
| Height | .78 | Misspelled words | .76 | .74 | .80 |
| Standing height/sitting height | .83 | Addition | .90 | .54 | .75 |
| Circumference of head | .75 | Multiplication | .90 | .69 | .84 |
| Width of head | .86 | Opposites | .96 | .88 | .90 |
| Arm length | .72 | | | | |
| Finger length | .71 | | | | |
| Average | .77 | Average | .83 | .70 | .76½ |

Thorndike[20] was the next to investigate the relationship between the abilities of twins. He tested fifty pairs of twins. No attempt was made to distinguish between identical and fraternal twins.[21] There were probably some identical twins in the group, since there were three more of the same sex than would be expected in a random selection. Table XXIX[22] gives a summary of Thorndike's results, from which he draws the following conclusions:

> If now these resemblances are due to the fact that the two members of any twin pair are treated alike at home, have the same parental models, attend the same school and are subject in general to closely similar environmental conditions, then (1) twins should, up to the age of leaving home, grow more and more alike, and in our measurements the twins 13 and 14 years old should be much more alike than those 9 and 10 years old. Again (2) if similarity in training is the cause of similarity in mental traits, ordinarily fraternal pairs not over four or five years apart in age should show a resemblance somewhat nearly as great as twin pairs, for the home and school conditions of a pair of the former will not be much less similar than those of a pair of the latter. Again, (3) if training is the cause, twins should show greater resemblance in the case of traits much subject to training, such as ability in addition or in multiplication, than in traits less subject to training, such as quickness in marking off the A's on a sheet of printed capitals or in writing the opposites of words.
>
> On the other hand, (1) the nearer the resemblance of

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[20] Thorndike, E. L., *Measurement of Twins,* New York, Science Press, 1905. Also *Archives of Psychology,* No. 1 (1905).

[21] There is approximately one twin birth in every 100 births, one set of triplets in each 10,000 births, and one set of quadruplets in 1,000,000 births. About three pairs of twins out of eight are unlike sex. This fact indicates that about one out of every four pairs of twins are identical, the other three being fraternal.

[22] Data taken from Thorndike, E. L., *op. cit.,* p. 9; and *Educational Psychology,* Vol. III, New York, Columbia University, 1914, pp. 248–250.

> young twins comes to equalling that of old, (2) the greater the superiority of twin resemblance to ordinary fraternal resemblance is, and (3) the nearer twin resemblance in relatively untrained capacities comes to equalling that in capacities at which the home and school direct their attention, the more must the resemblances found be attributed to inborn traits.
>
> The older twins show no closer resemblance than the younger twins, and the chances are surely four to one that with an infinite number of twins tested the 12-14-year-olds would not show a resemblance .15 greater than the 9-11-year-olds.
>
> * * *
>
> The facts then are easily, simply and completely explained by one simple hypothesis; namely, that the natures of the germ cells—the conditions of conception—cause whatever similarities and differences exist in the original natures of men, that these conditions influence body and mind equally, and that in life the differences in modification of body and mind produced by such differences as obtain between the environments of present-day New York City public school children are slight.

To claim that any shift in correlations between ages nine to eleven and twelve to fourteen is due to environmental influences seems questionable. Even if environmental influences should make twins more alike, the small differences at the relatively late ages of nine to fourteen should not be expected to show in the correlations.

Thorndike employed careful techniques for measuring certain mental differences and used correlation methods for determining the significance of the results but, like Galton, he probably placed undue emphasis upon the influence of heredity in explaining relationships.

Other more recent studies[23] have generally used intelligence tests and various achievement tests. Similar or identical twins have been found to be much more alike than dissimilar or fraternal twins. Correlations in intelligence scores for the former average near .90, while those for the latter are nearer .70. Similar relationships were found for tests more dependent upon experience, such as achievement tests. As can be seen from Table XXX, adapted from Newman, Freeman, and Holzinger, all the correlations for identical twins are higher than for fraternal twins:

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[23] See Merriman, C., "The Intellectual Resemblance of Twins," *Genetic Psychological Monographs,* Vol. XXXIII, No. 152 (1923); Lauterbach, C. E., "Studies in Twin Resemblance," *Genetics,* Vol. X (1925), pp. 525-568; Wingfield, A. H., *Twins and Orphans,* London, Dent, 1928; and Newman, H. H., Freeman, F. N., and Holzinger, K. J.,

TABLE XXX

COMPARISON OF 50 PAIRS EACH OF IDENTICAL AND FRATERNAL TWINS

| | *Identical Twins* | *Fraternal Twins* |
|---|---|---|
| Standing height | .98 | .93 |
| Sitting height | .96 | .90 |
| Weight | .97 | .90 |
| Cephalic index | .90 | .58 |
| Binet M.A. | .92 | .83 |
| Binet I.Q. | .91 | .64 |
| Otis I.Q. | .92 | .62 |
| Stanford achievement test: | | |
| Word meaning | .92 | .80 |
| Arithmetic computation | .88 | .86 |
| History and literature | .90 | .85 |
| Educational age | .95 | .88 |
| Woodworth-Mathew's test | .56 | .37 |
| Tapping speed | .81 | .69 |

The correlations for physical traits are generally slightly higher than for mental traits. Intelligence test correlations do not differ greatly from those for educational subjects. If due allowance were made for the lower reliability of the mental and educational tests, they probably would be as high as, if not higher than, the correlations for some of the physical traits. The one test which is much lower than all the others is the Woodworth-Mathews test

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*Twins: A Study of Heredity and Environment,* Chicago, University of Chicago Press, 1937.

of psychoneurotic tendencies. Whether this correlation is due to a low reliability of the test or to a low relationship between twins in psychoneurotic tendencies, we do not know.

An interesting deviation in the method of studying twins has recently been adopted.[24] One of a pair of twins is given extensive training in some function, while the other twin is brought up without any special training. For example, in one study the twin called Johnny was given practice in the use of certain reflexes, as in walking, reaching, riding a tricycle, roller skating, climbing ladders, and so forth. This training continued till Johnny was twenty-two months old. Johnny was clearly superior in motor skills, especially in such things as climbing and roller skating. Eleven months later the other twin, Jimmy, was given some of the same kind of training. At the end of this period, the twins showed no difference in I.Q. and little difference in manual skill. Johnny was more deliberative and persistent throughout and after the training. Two other studies, one in motor skills and the other in language ability, and both using larger groups of twins, came to the same general conclusions. Early training produces unusual accomplishments, but older, more mature children can generally reach similiar attainments after a short period of practice.

**Studies of identical twins reared apart by Newman, Freeman, and Holzinger.** Another approach to the

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[24] See Gesell, A., and Thompson, H., "Learning and Growth in Identical Infant Twins," *Genetic Psychology Monographs,* Vol. VI, No. 1 (1929), pp. 5–120; Hilgard, J. R., "The Effect of Early and Delayed Practice on Memory and Motor Performance Studies by the Method of Co-Twin Control," *Genetic Psychology Monographs,* Vol. XIV, No. 6 (1930), pp. 493–567; Strayer, L. C., "Language and Growth," *Genetic Psychology Monographs,* Vol. VIII, No. 3 (1930), pp. 209–319; and McGraw, M. B., *Growth: A Study of Johnny and Jimmy,* New York, Appleton-Century, 1935.

## TABLE XXXI

### COMPARISON OF 19 PAIRS OF IDENTICAL TWINS REARED APART

| *Case* | *Sex* | *Birthplace* | *Age when Separated* | *Age when United* | *Height in Inches* | *Weight in Pounds* | *Kind of Home* | *Kind of Work* | *Amount of Schooling* | *Binet I.Q.* | *Otis I.Q.* | *Educational Age* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Female | London | 18 mos | 18 yrs | 61 | 102 | Average small city. | Office worker | 2 yrs. high school. | 97 | 108 | 16.8 |
| | | | | | 61 | 115 | Unfavorable London district. | Office worker | 2 yrs. high school. | 85 | 90 | 15.1 |
| 2 | Female | New York City. | 18 mos | 21 yrs | 58 | . . . | Good city home. | Factory and office worker. | 5th grade | 66 | 69 | 10.11 |
| | | | | | 59.1 | 5 lbs. heavier. | Average | Machinist and office worker. | 3 yrs. normal college. | 78 | 84 | 14.1 |
| 3 | Male | Small Illinois village. | 2 mos | 22 yrs | 62.8 | 124 | Good city | Furniture factory worker. | High-school graduate. | 99 | 110 | 17.1 |
| | | | | | 62.4 | 114 | Average | Postmaster | 1 yr. college | 101 | 100 | 15.9 |
| 4 | Female | Ohio | 5 mos | 29 yrs | 65.4 | 111 | Good | Store clerk | High-school graduate. | 106 | 111 | 17.3 |
| | | | | | 66¾ | 138½ | Good | Store clerk | 8th grade | 89 | 97 | 14.5 |
| 5 | Female | Iowa town | 14 mos | 16 yrs | 62.3 | 102 | Good | Storekeeping wife. | 10th grade | 89 | 86 | 14.8 |
| | | | | | 62.6 | 110 | Good | Businesswoman. | 11th grade country school. | 93 | 89 | 15.2 |

## TABLE XXXI (*Continued*)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Female... | Small Canadian town. | 3 yrs..... | 16 yrs... | 67.5 | 208 | Poor......... | Housewife; married at 17; unhappy. | 3rd grade..... | 102 | 68 | 12.7 |
| | | | | | 67.5 | 227 | Poor......... | Farmworker.... | 3rd grade..... | 94 | 70 | 12.11 |
| 7 | Male.... | Indiana.... | 1 mo..... | 13½ yrs. | 57 | 86 | Good........ | Student........ | 8th grade..... | 105 | 105 | 15.11 |
| | | | | | 58 | 86½ | Fair......... | Student........ | 8th grade..... | 106 | 101 | 15.9 |
| 8 | Female... | Indiana.... | 3 mos.... | 15 yrs... | 66 | 121 | Excellent..... | Student........ | 10th grade.... | 92 | 101 | 14.7 |
| | | | | | 65 | 120 | Fair......... | Student........ | 10th grade.... | 77 | 86 | 13.6 |
| 9 | Male..... | Wisconsin.. | Infancy.. | 19 yrs... | 69 | 135 | Good........ | Manual laborer. | High-school graduate. | 102 | 104 | 17.6 |
| | | | | | 70 | 132 | Good........ | Dairy-farm worker. | High-school graduate. | 96 | 99 | 16.10 |
| 10 | Female... | Chicago.... | Fewmos . | 5 yrs.... | ¼ in. taller. | 4 lbs. heavier. | Superior...... | At home....... | 8th grade..... | 122 | 113 | 15.1 |
| | | | | | .... | ... | Average...... | At home....... | 7th grade..... | 127 | 121 | 16.8 |
| 11 | Female... | Ohio town.. | 18 mos... | 28 yrs... | 61 | 139 | Average...... | Salesgirl........ | 3rd grade..... | 92 | 94 | 13.1 |
| | | | | | 62 | 141 | Good ...... | School teacher.. | College graduate. | 116 | 106 | 18.10 |
| 12 | Female... | Unknown... | 1½ yrs... | 29 yrs... | 59 | 72 | Good........ | Beauty culturist. | High-school graduate. | 116 | 116 | 18.8 |
| | | | | | 59 | 98 | Good........ | Salesgirl........ | 8th grade..... | 109 | 115 | 17.6 |
| 13 | Male..... | Large Michigan city. | 3 wks.... | Only occasionally. | .... | ... | Average...... | Student........ | High-school graduate. | 94 | 106 | 16.4 |
| | | | | | ⅓ in. taller. | 1¼ lbs. heavier. | Average...... | Golf caddy..... | High-school graduate. | 95 | 103 | 15.9 |

## TABLE XXXI (*Concluded*)

| *Case* | *Sex* | *Birthplace* | *Age when Separated* | *Age when United* | *Height in Inches* | *Weight in Pounds* | *Kind of Home* | *Kind of Work* | *Amount of Schooling* | *Binet I.Q.* | *Otis I.Q.* | *Educational Age* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | Female... | Small Colorado town. | 6 mos.... | 39 yrs... | 64 | 113 | Average...... | Housewife...... | 8th grade..... | 85 | 96 | 14.8 |
| | | | | | 63 | 116 | Average...... | Housewife...... | 8th grade..... | 84 | 86 | 13.3 |
| 15 | Male..... | NewEngland town. | Early infancy. | 26 yrs... | ½ in. taller. | 1¼ lbs. heavier. | Average...... | Electrician...... | 1 yr. high school. | 91 | 92 | 13.3 |
| | | | | | .... | ... | Average...... | Electrician...... | 3 yrs. high school. | 90 | 84 | 13.5 |
| 16 | Female... | Michigan city. | 2½ yrs... | 11½ yrs. | .... | 72 | Average...... | Student........ | 6th grade..... | 90 | 87 | 10.10 |
| | | | | | 3¼ in. taller. | 92 | Good........ | Student........ | 6th grade..... | 88 | 90 | 10.11 |
| 17 | Male..... | Large Kentucky city. | Very early | 14 yrs... | ⅔ in. taller. | ... | Good........ | Student........ | 9th grade..... | 115 | 119 | 14.8 |
| | | | | | .... | 3¼ lbs. heavier. | Fair........ | Student........ | 9th grade..... | 105 | 119 | 14.8 |
| 18 | Male..... | Tennessee Mountains. | About 1 yr. | 29 yrs... | Same for both. | 14 lbs. heavier. | Average...... | Engineer....... | High-school graduate. | 96 | 104 | 16.0 |
| | | | | | Same for both. | ... | Poor ......, | No regular work. | 8th grade..... | 77 | 84 | 13.1 |
| 19 | Female... | New York City. | 6 yrs..... | 17 yrs... | ½ in. taller. | 130 | Fair........ | Nurse.......... | 8th grade..... | 88 | 89 | 14.9 |
| | | | | | .... | 169 | Fair ....... | Nurse.......... | 8th grade..... | 79 | 90 | 14.4 |

influence of near ancestry has been made by a study of identical twins reared apart. Newman, Freeman, and Holzinger[25] collected case histories and gave intelligence, achievement, and a few personality tests to nineteen pairs of identical twins who had been separated in early childhood and had lived apart at least until near adulthood. If nurture[26] has no influence on behavior, then these twins living apart should be just as similiar as identical twins brought up together. If nature has no influence, then these twins should be no more alike than any children reared under the same conditions. If nature and nurture both play a part, then we should find such twins somewhere between these two extremes.

Table XXXI gives a brief summary of the life histories of the nineteen pairs of twins. It is apparent from a study of these data[27] that some of the pairs of twins, despite the fact that they were reared apart, had a somewhat similar background of experience, both in the home and in school. Cases 3, 4, 5, 6, 7, 12, 13,

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[25] Newman, H. H., Freeman, F. N., and Holzinger, K. J., *Twins: A Study of Heredity and Environment,* University of Chicago Press, 1937.

[26] These authors point out the fact, often not mentioned by other writers, that some differences between identical twins come from the asymmetry of the first cell. When this first cell divides, although the chromosomes separate evenly into each half, some factors—like those which differ from one half of the body to the other—are not fully represented in each of the two daughter cells. These authors find reversal of handedness, hair whorls, dental irregularities, palm- and fingerprint reversals much more common in identical twins than in fraternal twins. This they explain by asymmetry in the first cell division. There is also often a dissimilar blood supply from the placenta to the two embryos, which may often be even greater than in fraternal twins.

[27] The following interpretation is made largely by the present writers from the original data for the first nine cases reported principally from the *Journal of Heredity*. The last ten cases are taken from the text *Twins: A Study of Heredity and Environment*. While the interpretation is similar to that given by the authors of the last-named text, the present writers continued the method begun before the appearance of the text.

14, 15, and 19 are of this type. The other nine cases show dissimilar home or school experiences.

A comparison of the I.Q.'s of these nineteen pairs of twins shows an average difference of 8.2 ± 1 points for Binet scores; and one of 8.0 ± .9 points for Otis scores.

TABLE XXXII

A Comparison of Intelligence Test Scores for Fraternal and Identical Twins

| *Investigator* | *Test Used* | *Scores of Fraternal Twins* | | *Scores of Identical Twins* | |
|---|---|---|---|---|---|
| | | *Number tested* | *Average I.Q. difference* | *Number tested* | *Average I.Q. difference* |
| Merriman | Stanford-Binet | 83 | 8.2 | 22 | 4.9 |
| Tallman | Stanford-Binet | 39 | 7.37 | 63 | 5.08 |
| Wingfield | Group tests | 57 | 11.74 | 45 | 6.23 |
| Hirsch | Group tests | 58 | 13.8 | 38 | 2.3 |
| Averill and Miller | Stanford-Binet | 10 | 5.7 | 0 | .... |
| Bakwin | Stanford-Binet | 0 | .... | 13 | 4.0 |
| Newman, Freeman, and Holzinger | Stanford-Binet | 50 | 9.9 | 50 | 5.3 |
| Average (unweighted) | ................ | .. | 10.60 | .. | 4.75 |

If we divide the children as suggested in the above paragraph, according to similar and dissimilar environments, those with similar environments show an average Binet I.Q. difference of 5.1 and an Otis I.Q. difference of 5.6.[28] Those with dissimilar environments have an average Binet I.Q. difference of 11.7 and an Otis I.Q. difference of 10.7. These differences should be compared with the data collected by these same authors for fifty pairs each of fraternal and identical twins reared together, and with similar studies of other investigators, as shown in Table XXXII, after Schwesinger.

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[28] In considering the average difference between pairs of twins, as is done above, it must be recognized that the differences observed may be solely the product of errors of measurement. If the average difference

If these nineteen pairs of twins are typical, it seems that identical twins reared apart differ on the average almost as much as fraternal twins reared together. In fact, the nine pairs of identical twins with dissimilar environments differ even more than fraternal twins reared together.

Three more extensive case histories follow, giving further details about these typical cases:

### Case Studies of Some Identical Twins Reared Apart

*Case 3.* Male twins, separated when two months of age and met first at age 22. C lived in small cities most of his life. He completed high school at the age of 18. He worked as office clerk for two years, then took a ten-month commercial course. C then did more office work and saleswork. At the time of examination, he had been studying accounting for three months. C's foster parents were in moderate circumstances and he was the only child. O never lived in cities and moved about a great deal, his environment having been distinctly rural. He completed high school at eighteen years of age also. O studied architectural engineering at Iowa State College for six months. Since leaving college, he has been assistant postmaster in a small town. O was one of three children. His foster parents seem to have had more intellectual interests than those of C, but in general there is not much contrast in home environments. O had an I.Q. of 101, C an I.Q. of 99 (Stanford-Binet). On the Thurstone

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is no larger than the standard error of a single measure, there may be no true difference at all. On the other hand, if the observed difference is two or three times greater than the standard error of a single measure, chance errors of measurement operate so as to compensate for each other and will then scarcely need to be considered. The differences observed above between twins of similar environment is probably due largely to chance errors of measurement, while those between twins of dissimilar environments are so great as to be little increased by such chance errors. The similarity of twins of similar environments, as compared with those of dissimilar environments, is even greater than the above figures seem to indicate.

psychological examination, C appeared superior to O. On the performance test, C was only slightly superior. He was also superior on the Otis Self-Administering test. C, who has had somewhat more education, surpasses O on the school achievement tests. On the psychological tests of tempermental and emotional traits, the twins are utterly different, O being more emotional and temperamental. Observers were forcibly struck by this fact at the very beginning.

*Case 2.* Female twins, separated when eighteen months of age, reared apart, and unknown to each other until the age of twenty-one. They were twenty-seven years old when examined. For the last four years they have lived in the same city and have seen much of each other. E completed the fifth grade at eleven years of age and had no more schooling. She had no home schooling whatever. She worked at home until about sixteen, when she went to work in a shirt factory. At eighteen she started to work in a dentist's office, where she was employed at the time of examination. G completed the grades and the high school in parochial schools. She had training in piano also. She then took a three-year normal-school course. G taught fourth grade for two years and continued piano practice. For two and a half years prior to the examination she had been assistant in a physician's office. The two social environments showed no important differences. The Stanford-Binet I.Q. for E was 66, for G 78. G was also much superior on the Otis test (a performance test). As might be expected, G was decidedly superior in all school achievement tests. In the tests of emotional and temperamental traits, the twins seem to be remarkably similar.

*Case 5.* Female twins, separated at fourteen months and reared entirely apart until sixteen years of age. They were thirty-eight years of age at the time of examination. After having met at sixteen, they were separated again for several years; and at twenty they were reunited once more for a year, when D married. B married two years later. B has four children and D has six. Since D married, they have seen little of each other. B completed eleven grades and D ten, the former in good-sized towns and the latter in country schools. B had an easy life after her marriage, whereas D's life was extremely hard. B has had a good social environment, while D has had almost no social life. B is in much better physical condition and looks considerably younger (perhaps ten years) than D. The I.Q.'s were: for B, 93; for D, 89 (Stanford-Binet). B also showed a slight advantage over D on the Thurstone, Otis, and International tests. B was slightly superior in tests of school achievement. On the whole, the intellectual differences were not great. On the psychological tests of temperament and emotion, they were similar in some and dissimilar in others, D being somewhat more emotional than B. In general they are more alike than different in the nonintellectual traits. Of the reported cases of identical twins reared apart, this is the first to reveal so slight a difference in both intelligence and temperament.

As Newman, Freeman, and Holzinger well say, they have not solved the problem of the relation of heredity and environment. These authors point out that no single index will show the relative importance of heredity and environment in modifying or controlling human behavior. In some fields the one factor may predominate, while in other fields the other factor may predominate. The predominating factor shows up in the relative likenesses of the pairs of twins. For example, in eye and hair color and many physical measurements, pairs of twins are usually very similar; whereas in personality and temperament, they are often very different.

## Summary

In conclusion, it may be said that most of the older studies explained family resemblances as due to heredity. Galton was the first investigator to stress this point of view. In recent years there has been a gradual shift from this point of view, with more and more emphasis upon the effects of environment. Such studies as those of Gordon, with canalboaters' children, and Freeman, with foster children, show how important environmental influences are. Yet we must not commit the error of placing too great stress on this new emphasis. Studies of twins, and especially of identical twins, show that heredity plays no small part in explaining many of the similarities between near relatives.

We may summarize by saying that we would not expect to find any relationship between unrelated people who have not lived together. Unrelated children, such as foster and true children reared in the same home, come to show some similarities in mental characteristics. Siblings ordinarily correlate about .50 on both physical and mental traits. Fraternal twins generally correlate .70 to .80 when reared together. Identical twins living together correlate .90 to .95 when measured with reliable tests, but when they have been separated early in life and have lived under different environmental conditions, they may become no more alike than fraternal twins who have been reared together. This fact is the more striking when we realize that fraternal twins are no more alike, or at least not much more alike, than ordinary siblings in their hereditary background. All of these things show how complicated and involved are the factors which produce likenesses and differences among members of the same family.

### Exercises

1. Explain and amplify this statement: "Among relatives, the closer the relationship, the more alike are environmental influences as well as hereditary."

2. What is Galton's theory of ancestral inheritance? How do you reconcile the inheritance of one and nine sixteenths per cent of all determiners from each great grandparent with the fact that there are but twenty-four pairs of chromosomes?

3. Why should not Galton's study of 977 eminent men be interpreted in a way contrary to his interpretation and be considered as showing the influence of being *reared* in a good family?

4. Name and describe any factors in Pearson's study of siblings which would tend to make his correlations: (*a*) too high; and (*b*) too low.

5. What was the general conclusion of F. A. Woods in his study of the royal families of Europe? How are the correlations he obtained affected by his use of: (*a*) subjects from families highly interrelated; and (*b*) data which were estimates rather than accurate test results?

6. Compare the results of the studies of eminent men by Terman and Cattell. How did each select the subjects to be included in his study? Explain how their respective methods of selecting subjects determined in part the nature of the results.

7. Give reasons why a group of thirteen-year-old schoolchildren may not have an average I.Q. of 100. Suggest an explanation for the fact that the children of a public grade school in the residential district of a metropolitan center had an average I.Q. of 116.

8. Explain how the factor of selection may have operated in Freeman's study, and indicate how this may have affected his correlations between foster parents and adopted children.

9. How does adoption at a very early age—say, before six months—rule out the factor of selection? How is such homogeneity of subjects as is found in Burks' study likely to affect correlations?

10. Compare the subjects used in the two studies of foster children by Freeman and Burks, showing how the results may have been determined in part by their selection of subjects.

11. Since about three eighths of all twins are boy-girl twins, it is estimated that about one fourth of all twins are identicals. Justify or refute this estimate.

12. Using intelligence test scores, what is the typical correlation found for: (*a*) identical twins; and (*b*) like-sex fraternal twins? To what is the difference in correlations to be attributed?

13. Referring to the table of data for fifty pairs each of identical fraternal twins, note the difference in correlations for physical traits and intelligence test results. To what factors can we attribute the difference: (*a*) in average correlation; and (*b*) between correlations for identical and fraternal twins?

14. What have studies of twins indicated as to the effect of early training in manual skills?

15. Describe the method of studying environmental influences by using identical twins? What are some of the assumptions made in the interpretation of these studies?

16. Estimate the significance of an average difference of five I.Q. points between twins. To what may such a difference chiefly be attributed?

17. What was Galton's explanation for family resemblances? How has emphasis upon heredity tended to shift since Galton's studies?

18. Give some quantitative statements of the similarities of: (*a*) ordinary siblings; and (*b*) fraternal and identical twins. Does the type of ability measured have any influence on the size of the correlations?

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## CHAPTER VIII

# Differences in Intelligence

In this chapter we shall be concerned with intelligence and especially with how people differ in intelligence. Since differences are the important topic in this discussion, there will be no extended discussion of the theoretical problems involved in the definition of the term *intelligence.* We shall be concerned with the definition only in so far as it is necessary for an understanding of the issues involved and to make the discussion of differences meaningful and significant. However, in order to do this, it will be necessary to consider briefly what intelligence is and what elements or factors are included in intelligence.

It is generally agreed that people differ greatly in what is often called *common sense.* Such terms as *dumb, ignorant, bright,* and *brilliant* are sometimes used in discussing people. Just what is meant by common sense, or intelligence, is not always clear. One of the most widely accepted formal definitions is that intelligence is the ability to solve novel situations. A similar definition of intelligence is that it is the ability to make successful adjustments in life.

Another question of equal importance, as well as equal difficulty, is that of the nature of intelligence. Is intelligence a unitary trait or is it made up of many different traits? The English psychologist Spearman[1] is one of the most ardent advocates of the theory of the unitary character of general intelligence. He believes that mental ability is made up of two factors: *g*, or general intelligence; and *s*, or special ability. Any mental process is made up of these two factors. The amount of *g* varies from one task to another. For example, in a good intelligence test or in mathematical problems, *g* is high. On the other hand, in golf or handwriting *s* is high and *g* is low. Spearman's arguments for a *g* factor can be described briefly by saying that, if a test such as card sorting correlates highly with others such as a dotting test and an alphabet-finishing test, the latter two tests will have a high relationship. These relationships give evidence of the *g* factor. If, on the other hand, the interrelationships are low, then there is a small amount of *g* present.[2]

Many American psychologists believe that intelligence is not a single unitary trait, but a composite of several independent abilities. One of the most active proponents of a multiple-factor theory is Thurstone.[3] He came to the conclusion that there are at least six or seven

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[1] Spearman, C., *The Abilities of Man*, New York, Macmillan, 1927.

[2] Spearman has developed a correlation method for demonstrating *g*. By this method, pairs of tests are correlated with each other and the pairs of correlations are then compared. One set of relations between four tests is shown by the factoring tetrad equation, as it is called:

$$\frac{r\ 13}{r\ 23} = \frac{r\ 14}{r\ 24}$$

There would also be two other tetrad equations for these tests. If more than four tests are compared, they must be resolved to sets of tetrads. The factor *g* is shown by these equation values to approximate 0 in value, which Spearman finds to be true. Other investigators have admitted that the relationships often approach 0 but have given other explanations for the fact.

[3] Thurstone, L. L., *Vectors of the Mind*, Chicago, University of Chicago Press, 1935; and his more recent, unpublished writings.

large factors, as well as some lesser ones, contained in what we generally call intelligence. His evidence is based upon a statistical method called *factor analysis*.[4] This method gave seven principal axes or vectors: (1) facility with numbers; (2) verbal fluency; (3) visualizing; (4) memory; (5) speed in perceiving; (6) inductive ability; and (7) deductive ability. The great difference between the single-factor theory of Spearman and this point of view is that here all seven factors are relatively independent of one another, while in the former *g* is supposed to permeate all intellectual tasks. Probably most American psychologists hold to the multiple-factor theory of intelligence. One of the reasons for this belief is that, in practical life situations, intelligence does not seem to be equally applicable in all directions. Rather, it seems to be composed of many variables, some of which are more serviceable in certain situations while others are more serviceable in other situations. Furthermore, the way in which intelligence unfolds during childhood fits in better with the concept of intelligence as composed of a number of factors, each unfolding in its own time and way, thereby producing a somewhat harmonious general development. But it is not the purpose of this chapter to decide whether intelligence is composed of one factor or many, because most of what is known concerning differences can in one way or another be related to either the unitary theory or the multiple-factor theory of intelligence.

We shall now trace the growth of intelligence and how people differ in this respect. Like most other topics that have been discussed, there are two aspects of the problem as to the way in which people differ. People differ in intelligence during their life span; they also differ one from another at any age. These aspects will be discussed under the headings "Differences Within the Individual" and "Differences Between Individuals."

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[4] Thurstone's method of factor analysis is somewhat different from the tetrad method of Spearman. In factor analysis, interrelationships (tetrachloric *r*'s) are computed, not between subtests, but between every pair of elements of a test. This is done to determine the smallest number of independent abilities that need to be assumed in order to account for all the intercorrelations observed between the elements of the test.

## Differences in Intelligence Within the Individual

**Beginnings of intelligence.** The first question to be considered is at what age intelligence begins to develop. Several different answers have been proposed to this question. It has been suggested that intelligence begins at conception; at the first independent movements of the fetus; or at birth. Still others have thought that it does not begin to develop until some time after birth, as, for example, at the time when the child is first able to reason.

How we answer this question depends at least in part upon the definition of intelligence. If intelligence is defined as the capacity to make more or less adequate adjustments to life situations, then there may be some intelligence before birth, although the important adjustments begin to be made at or shortly after birth. If, however, intelligence is defined as the ability to do abstract thinking, then the age at which it begins is considerably later. Although many different opinions are held, there seems to be a more general acceptance of intelligence in terms of adjustments. Intelligence would then begin to develop near birth, a point of view which is further supported by a study by Thurstone and Ackerson.[5] By means of the statistical device of projecting the growth curve of intelligence backward from certain known points, these investigators came to the conclusion that the point of no intelligence whatever, from which growth begins, is two or three months before birth. While this does not settle the matter, it does tacitly accept the prevailing ideas concerning intelligence and serves to be a more satisfactory solution than most of the others that have been proposed.

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[5] Thurstone, L. L., and Ackerson, L., "The Mental Growth Curve for the Binet Tests," *Journal of Educational Psychology,* Vol. XX (1929), pp. 569–583.

**Rate of growth in intelligence.** The next problem to be considered is the rate at which intelligence develops. This problem introduces several subsidiary ones. For example, is intelligence a unitary trait or is it a composite of many factors? If it is unitary, then we should expect development to be regular and consistent. If it is a composite, it may be regular or irregular, depending upon whether there is a sequence between the parts of which it is composed.

Professor Gesell[6] of Yale University, who has made a very extensive study of the growth of intelligence in infancy, believes that intelligence is made up of many parts, but he holds that there is much orderliness in its development. According to him, intelligence develops in somewhat the same way as height, which is determined by the length of the long bones of the body. The parts grow, first one and then another, but there is a definite relation and sequence among them. The following quotation states Gesell's viewpoint:

> The swiftness of development in infancy no one will be disposed to deny. The orderliness of this development is not so well recognized, but it is a fact of great significance. There are certain basic uniformities in the dynamics of development which apply to all infants, normal, abnormal,

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[6] Gesell, Arnold, *Infancy and Human Growth,* New York, Macmillan, 1928, p. 124.

> superior, inferior. There is a large system of uniformities which characterize all normal infants and keep them traveling in highly similar routes and on highly similar time tables. These uniformities are not stereotyped; they shade into small but important variations. Differential psychology must define and interpret these variations. Genetic psychology will emphasize the underlying similarities.

If there is a general unfolding of intelligence, how does it take place? Important as this problem is, the evidence is more or less indirect. Our best measure of intelligence is by means of comparing the performance of one individual with that of another and not by any absolute scale.[7] In the various forms of the Binet scale, a child's performance is compared with that of other normal children. For example, we may find that a child passes tests equal to those passed by a normal five-year-old child. That is, he has a mental age of five years. Now, if the child is only four years old, he is brighter than average; if he is six years old, he is not normally intelligent. There is no good method of determining whether the difference between the performance of four- and five-year-olds is the same as that between five- and six-year-olds. A child may be tested from time to time and his scores may be compared with those of normal children of his age, but the norms for children of different ages are only averages of what children of these ages do on the tests. We know there is progress from year to year, but there is no way of telling how much progress. Most people believe that the relative progress is greatest in the earlier years and that it gets less and less as the child grows older. If this assumption is correct, the form of the curve representing mental growth is a negatively accelerated one. This belief is supported by the analogies drawn between mental growth and physical growth, and, with less justification, between mental growth and the typical learning curve.

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[7] Two or three attempts have been made to measure intelligence in terms of an absolute scale. Thorndike, in his CAVD intelligence examination, attempted to establish an absolute zero and measure intelligence from this point in units of equal value. In so doing, he arrived at a negatively accelerated curve of mental growth. However, so many difficulties were involved in constructing the test on this basis that we cannot be too certain about the accuracy of the units in terms of their absolute values. For a further discussion, see Thorndike, E. L., Bregman, E. O., and Cobb, M. V., *The Measurement of Intelligence,* New York, Columbia University, 1927; also Thurstone and Ackerson, *op. cit.*

At first thought, the evidence in favor of a negatively accelerated curve may seem stronger from group tests than from individual tests. Generally there are greater differences between the scores for the lower years than for the upper years. But the form of the curve representing growth from year to year depends upon the items of the test and the methods of scoring, as well as upon mental growth. Tests are so constructed that scores are progressively higher from age to age. As a rule, however, there are more easy than difficult items in a test, which may also partly explain the greater differences in scores between successive ages in the early years. These facts indicate that we must be careful in interpreting the form of the curve of mental growth from group test scores. However, the weight of opinion and almost all available indirect evidence lead to the conclusion that intelligence develops in a form represented by a negatively accelerated curve—that is, the increase is more rapid in the earlier years, gradually becoming less and less until maturity is reached, after which it ceases altogether.

As has already been suggested, the rate of acceleration of mental growth varies for different children. This problem will be discussed in a later part of this chapter. Suffice it here to say that mental ability improves from year to year up to a certain point and that the rate varies for different individuals, but we do not know how much it improves from year to year. We have some evidence that, on the average, there are no great spurts or plateaus in the typical curve, but we do not know what ratio the mental growth of the average child between five and six is, for example, to his growth from ten to eleven.

**Age of mental maturity.** Another problem to be considered is the age at which intelligence ceases to develop.

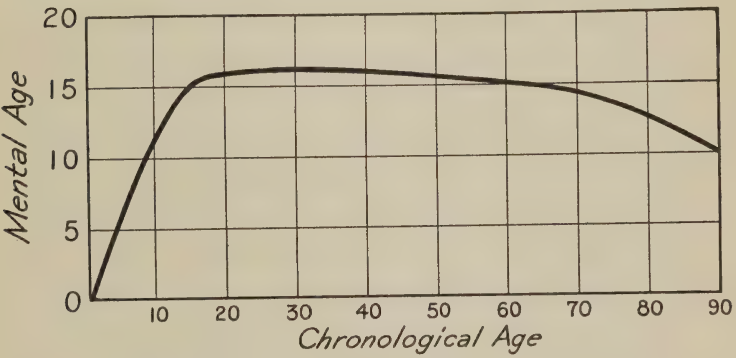

Fig. 27.—A Hypothetical Curve of Intelligence.

Terman, in constructing the earlier Stanford revision of the Binet scale, considered sixteen years as the age beyond which there is no gain in mental ability. In the 1937 revision, he uses fifteen years as the upper limit. Other writers have suggested ages from thirteen to twenty or beyond. The fact is that there is probably considerable difference between individuals in the age at which mental maturity is reached. Many theoretical reasons and some experimental evidence point to the fact that there is as much difference between individuals in this respect as in the rate at which intelligence develops. If this is true, some people reach mental maturity as early as at fourteen, while others do not reach their highest attainment before twenty or possibly even thirty. If by intelligence we mean the ability to learn or profit by experience, then the *average* age at which this ability ceases to improve is probably somewhere between sixteen and twenty years. Since growth at this period in life is very slow, it does not make much practical difference which age is selected; but it must be kept in mind that there are many people who vary from this average.

There have been no extensive studies in which the same persons have been tested from year to year in these higher ages. For the most part, the evidence for differences in the age at which mental maturity is reached is anecdotal rather than experimental. That many persons of slow and unpromising mental growth during childhood have, perhaps over a long period of growth and at relatively late maturity, reached high levels of mental ability is suggested by the biography of numerous eminent men. Charles Darwin was below average in school and in college; it was not until after graduation that his brilliance became evident. Newton was the dullest boy in his class. Other men with similar early records are Richard Wagner, Louis Pasteur, and William Gladstone. Napoleon was only a mediocre student in military school; even after graduation, he was not much of a success in the army, and seriously considered withdrawing from the service. Sir Isaac Newton has said of himself that, at twelve, he was extremely inattentive to his studies and stood very low in his class. The biologist von Humboldt said that, in the first years of his childhood, his tutors were doubtful whether even the ordinary powers of intelligence would be developed in him, and that it was only in later childhood that he began to show any evidence of mental vigor. Finally, there is the case of David Hume, whose mother is reported to have said: "Our Davie's a fine good-natured cratur but uncommon wake-minded."[8] It should be understood that some of these cases of poor showing in school were due, not to lack of ability, but to a revolt against the prevailing formalism in the schools. Others, no doubt, were actual cases of absence of ability in the early school years.

There are also several cases of persons who showed evidence of greatness early in life but who failed to live up to their expectations, although these are more difficult to enumerate. One rather famous case is that of a professor's son who was graduated from college at the age of fourteen with a very brilliant record but who, several years later, was found working as a routine clerk in a New York office. Then there are also some other cases of children with I.Q.'s of close to 200 who, in later years, failed to live up to their early reputations. Such cases, however, are much more the exception than the rule.

On the other hand, there is abundant evidence of children who showed indications of brilliance from a very early age. John Stuart Mill began to read Greek at the age of three; he read Aesop's *Fables* in Greek between the ages of eight and thirteen, and also studied Latin, Greek, and mathematics during this same period. Beethoven is said to have played the piano at the age of eighteen months and to have composed when he was three years of age. Francis Galton is another illustration of a genius whose ability was apparent from a very early age; he could read at two and a half years and could sign his name before the age of three. The day before his fifth birthday he wrote his sister as follows:

> My dear Adele,
>
> I am four years old and can read any English book. I can say all the Latin substantives and adjectives and verbs

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[8] For a much more extended list of such examples, see Swift, E. J., *Mind in the Making*, New York, Scribners, 1908.

> besides 52 lines of Latin poetry. I can cast up any sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, 10. I can also say the pence table. I can read French a little and I know the clock.
>
> Francis Galton, February 15, 1827.

Catherine Cox Miles[9] in her study of the early mental life of 300 geniuses cites many other striking cases of youthful prodigies. This study shows that early evidence of greatness is the rule rather than the exception.

The writer once studied the mental tests of a group of about forty eighth-grade children and followed their records until their junior year in college. During this time most of them had taken five or six mental tests. Since different tests were used, the scores were translated into standard deviations for purposes of comparison. Some of the records showed a consistent gain from year to year during the whole period of study. Others seemed to progress for a while and then reached a level beyond which they did not progress. A few made little gain during the whole period. This study at least lends support to the belief that there are large individual differences in the age at which intelligence ceases to develop.

No doubt the variability in the age of mental maturity is one explanation for the fact that some pupils do well in grades and high school but do not succeed in college work. Other students do not seem to reach their real stride before college or even later in life. It must be noted that this is not the only explanation for such differences in accomplishment of the same individual at different ages, but it is one that is often not given sufficient consideration.

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[9] Cox (Miles), Catherine, *Genetic Studies of Genius*, Vol. II, Berkeley, California, Stanford University Press, 1926.

**Mental deterioration with age.** How long do we retain our maximum intellectual ability? There has always been a general agreement that individuals, if they live to old age, tend to lose their mental acuity. The popular phrase "second childhood" expresses this idea clearly. Until recently, however, the age of onset of mental decline and its rate of progress has been a matter of conjecture only. The first extensive evidence on the matter was collected by Yerkes[10] and Jones.[11] Yerkes studied the changes in scores for soldiers of different ages on the Army Alpha test. Jones gave the same test to a selected representative New England population varying in age from twelve to fifty-five. While both of these studies showed changes in scores according to age, it is certain that the older men were not representative of the normal population, and therefore the actual amount of decline was not obtainable from these studies.

More recently, Walter R. and Catherine Cox Miles[12] have made a more extensive and much more valuable study of this problem. As part of a larger project, these investigators gave a shortened form of the Otis self-administering intelligence test to 823 persons ranging in age from seven to eighty. These subjects were a random sampling from two representative cities, one a "manufacturing, industrial and banking town, population about 12,000, situated in an agricultural community, the capital of its county"; the other "a residential and banking town, population about 15,000, also situated in an agricultural region, the seat of several private schools and near a university." They were secured by the very clever device of paying various clubs, societies, and organizations of the towns for supplying their members as subjects for the tests. By this method many people coöperated in the study who would not have done

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[10] Yerkes, R. M., *Memoirs,* Vol. XV, Washington, D. C., National Academy of Sciences, 1921.

[11] See Thorndike, E. L., *Adult Learning,* New York, Macmillan, 1928.

[12] Miles, C. C., and Miles, W. R., "The Correlation of Intelligence Test Scores and Chronological Age from Early to Late Maturity," *American Journal of Psychology,* Vol. XLIV (1932), pp. 44–78.

### TABLE XXXIII

Showing Distribution of Scores on Short Otis Test by Semidecades for Two Typical American Cities

*City A*

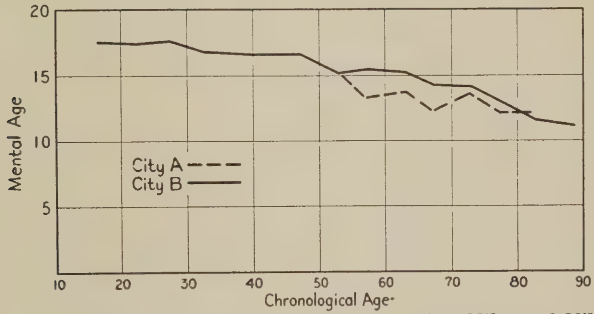
| *Semidecades* | *Number of cases* | *Means* | *Otis M.A.* | *Sigma* |
|---|---|---|---|---|
| 50–54 | 18 | 30.94 | 15.1 | 8.9 |
| 55–59 | 25 | 22.86 | 13.1 | 10.2 |
| 60–64 | 24 | 22.18 | 13.7 | 6.8 |
| 65–69 | 25 | 19.10 | 12.1 | 9.4 |
| 70–74 | 20 | 21.30 | 13.5 | 10.2 |
| 75–79 | 5 | 16.90 | 12.2 | 8.1 |
| 80–84 | 6 | 15.82 | 12.0 | 10.3 |
| 85–90 | 1 | (5.50) | (8.1) | 0 |

*City B*

| *Semidecades* | *Number of cases* | *Means* | *Otis M.A.* | *Sigma* |
|---|---|---|---|---|
| 15–19 | 51 | 38.50 | 17.5 | 8.0 |
| 20–24 | 40 | 38.10 | 17.3 | 7.0 |
| 25–29 | 40 | 39.22 | 17.4 | 8.2 |
| 30–34 | 43 | 35.26 | 16.8 | 10.3 |
| 35–39 | 44 | 35.06 | 16.7 | 8.4 |
| 40–44 | 48 | 33.82 | 16.5 | 11.4 |
| 45–49 | 42 | 34.50 | 16.6 | 11.0 |
| 50–54 | 63 | 30.98 | 15.1 | 11.6 |
| 55–59 | 56 | 28.74 | 15.4 | 9.0 |
| 60–64 | 50 | 27.94 | 15.1 | 11.2 |
| 65–69 | 53 | 24.22 | 14.3 | 9.6 |
| 70–74 | 42 | 23.78 | 14.1 | 10.5 |
| 75–79 | 26 | 20.46 | 13.0 | 8.6 |
| 80–84 | 13 | 14.50 | 11.6 | 9.4 |
| 85–89 | 5 | 15.30 | 11.1 | 9.6 |
| 90–94 | 1 | 15.50 | 11.1 | 0 |

so if no fees had been paid or if the remuneration had been given directly to the subjects. Practically all subjects coöperated willingly and were interested in the study. Such coöperation, as well as a representative sampling, was essential in order to make the study valid.

The results of the study are presented in Table XXXIII and Figure 28. From these data we can see that, on the average, intelligence seems to develop up to about the age of twenty, remains relatively constant to about the age of forty, and then begins to decline. The decline is not very rapid before the age of sixty, after which it becomes more so. The few subjects who were near ninety had a mental age of about ten or eleven years.



*After Miles and Miles*

**Fig. 28.**—Decline in Mental Age in Later Maturity.

Despite the precautions taken in this study, there are several reasons why the results may not be a true measure of age differences in mentality.

First, as the authors admit, the short fifteen-minute form of the Otis test may unduly penalize the older subjects. Although the authors obtained reliability coefficients of from .90 to .97 between the longer form of the test and the shorter form given to the younger subjects, this does not prove that the older subjects might not have been unduly handicapped by the speed factor of the shorter test. Second, while the subjects were assumed to be a representative sampling of a normal population, the test result showed an average I.Q. of 110 for the younger subjects in the one town and of 116 for those in the other town. It has been found that the I.Q. of a normal population averages about 100; therefore, either the I.Q.'s for the shorter form of the Otis test were too high or these subjects were above the average of a normal population in ability. In either case, it is fair to assume that the scores for the group as a whole and for all ages tended to range higher than for a normal population. Although this condition would not distort the form of the curve representing age differences in intelligence, it would not present a true picture of average mental ability for any age.

While these two possible sources of error in the Miles' study are in opposite directions, especially for the older members of the population studied, we cannot estimate how nearly one may compensate for the other. There is also the question of how much variation there is in loss of mentality. Common sense and the sigma of the decile age scores both lead us to believe that the extent and rate of mental decline are much higher in some persons than in others.[13]

In the Miles study it was suggested that at least part of the loss in test scores for the later ages may have been due to the speed factor in the Otis test. In fact, later studies by Lorge[14] and others indicate that this is true. Lorge gave a battery of intelligence tests to 143 subjects ranging in age from twenty to seventy years. Among the tests used was the Thorndike CAVD Test, which is a power test with no time-limitation factor. The Army Alpha and the Otis Self-Administering Tests, the latter with a twenty-minute time limit, were also used. The data below show no loss because of increased age on the test where speed is not a factor and considerable loss on the two tests where speed is a factor. Lorge did not have enough cases in the older age groups to make a good comparison with the Miles' results on the Otis test:

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[13] Anyone interested in the practical problem of old age and what to do about it is referred to Martin, Lillian, and Gruchy, Clare, *Sweeping the Cobwebs,* New York, Macmillan, 1933. In this book the authors tell about the work of the Old Age Center at San Francisco, California.

[14] Lorge, Irving, "The Influence of the Test Upon the Nature of the Mental Decline as a Function of Age," *Journal of Educational Psychology,* Vol. XXVII (1936), pp. 100–110, also Weisenberg, Theodore, Roe, Anne, and McBride, K. E., *Adult Intelligence,* New York, The Commonwealth Fund, 1936.

| *Age* | *CAVD* | *Army Alpha* | *Otis Self-Administering* |
|---|---|---|---|
| 20–25 | 405.25 | 149.61 | 44.39 |
| 27.5–37.5 | 405.66 | 142.26 | 39.26 |
| Over 40 | 405.55 | 128.70 | 33.39 |

These results prove rather conclusively that much of the loss on intelligence tests, at least up to seventy, is due to a loss in rate of speed in answering the questions rather than to a loss in ability to answer them. Coupled with this decrease in rate of speed in answering questions on the part of the older subjects is a tendency to conservatism and less likelihood that they will guess at answers to questions. These facts must be kept in mind in comparing age changes in intelligence between young and old people.

**Changes in learning with age.** Thorndike[15] has made an extensive study of changes in learning with age. On the basis of these studies, which were made with various kinds of learning and with groups differing greatly in ability, he came to the general conclusion that there is not much loss in ability to learn before the age of fifty. He says that there is probably a loss of from thirteen to fifteen per cent in "sheer ability" to learn between the ages of twenty-two and forty-two, and lists six factors as the cause of these changes: (1) the change in one's native capacity to develop the ability to learn; (2) the extent of and manner in which the inner growth of the ability to learn has proceeded; (3) the rate of deterioration which comes sooner or later to all people; (4) specific factors exerted by practice or experience; (5) general factors exerted by practice or experience; and (6) the effect of the lapse of time without practice.

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[15] Thorndike, E. L., *op. cit.*

In general, all the loss in ability to learn before forty-five, or even later, is relatively insignificant in relation to the lack of opportunity or interest in learning. After leaving school, most men and women become so engrossed in professional and social duties that they seldom expose themselves to learning. There is often a fear of competing with younger people and a dissatisfaction with one's progress which dulls any good motives toward learning. However, this aspect should not blind us to the fact that, after fifty or sixty, it is unusual to acquire much learning and not nearly as possible as before the age of forty. There is plenty of justification for the modern movement toward adult education. More leisure should mean more training, but we must not forget that there are limits beyond which extensive learning is not feasible.

Ruch,[16] in a later study, compared three different age groups for five different tests. The age groups were from twelve to seventeen, thirty-four to fifty-nine, and sixty to eighty-two. Table XXXIV gives the summary of the results of this study. There is a certain amount of loss in all kinds of learning, but much more in some kinds than in others. In general, the least loss occurs in learning of the usual types and the most loss in unusual material and in those things in which old habits would be a hindrance rather than an aid.

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[16] Ruch, Floyd, "The Differentiating Effects of Age Upon Human Learning," *Journal of General Psychology*, Vol. II (1934), pp. 261–286.

**Differences in mental abilities.** There is another way in which people differ. As already stated, it is generally assumed that mental ability is a composite rather than a single trait. If this is true, a person may be high in certain abilities and low in others. Although school subjects can hardly be considered as representing abilities, the principle is well illustrated by student grades. Some grades may be good, while others may be mediocre and still others low. There are several reasons why college grades are not a true measure of ability; nevertheless, they are a near enough measure to illustrate variability in human abilities.

TABLE XXXIV

Average Scores of Three Age Groups on Learning Tests

| *Test Used* | *Scores for Ages 12 to 17* | *Scores for Ages 34 to 59* | *Scores for Ages 60 to 82* | *Percentage of Loss from Youngest to Oldest Group* |
|---|---|---|---|---|
| Motor Learning: | | | | |
| Direct | 2857.0 | 2805.0 | 2392.0 | 16.3 |
| Mirror | 771.9 | 740.0 | 406.2 | 47.4 |
| Paired Associates: | | | | |
| Meaningful | 134.7 | 123.7 | 111.6 | 17.1 |
| Nonsense | 78.5 | 62.8 | 37.9 | 51.6 |
| False multiplication | 106.1 | 76.1 | 49.4 | 53.4 |

From the foregoing illustration, it may seem that there is little or no relationship between abilities. This is a rather widely held opinion among certain people. However, the evidence is conclusive that, at least in the elementary-school subjects, there is a rather high correlation between grades in different subjects. There are those who make A's in some subjects and "flunk" in other courses, but such people are the exception rather than the rule. Starch[17] made an extensive study of this problem. Table XXXV gives some of the results he found. Correlations are all high and some, of course, are higher than others. Similar subjects correlate higher than dissimilar subjects. In this list, spelling correlates least with the other subjects.

TABLE XXXV

Correlations Among Abilities in School Subjects

| | | | |
|---|---|---|---|
| Arithmetic and language | .85 | Language and spelling | .52 |
| Arithmetic and geography | .83 | Geography and history | .81 |
| Arithmetic and history | .73 | Geography and reading | .80 |
| Arithmetic and reading | .67 | Geography and spelling | .52 |
| Arithmetic and spelling | .55 | History and reading | .67 |
| Language and geography | .85 | History and spelling | .37 |
| Language and history | .77 | Reading and spelling | .58 |
| Language and reading | .83 | | |

With respect to college subjects, Stone[18] has shown that there is little or no relationship between laboratory grades and grades in languages or the social sciences. On the other hand, the correlation between the majority of college subjects is in the neighborhood of .40. Spearman would explain such correlations as due to what he calls the *g*, or common, factor in all these subjects. Whether or not this is the explanation, there is a certain general consistency in school grades. A pupil tends, for example, to be an A or a C student. Whether this comes by ability alone or with interest, industry, and reputation, makes no great difference in our present discussion.

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[17] Starch, Daniel, "Reliability and Distribution of Grades," *Science*, Vol. XXXVIII (1913), pp. 630–636.

[18] Stone, C. L., "The Significance of Alpha in Colleges," *Journal of Educational Psychology*, Vol. XIII (1922), pp. 298–303.

We must not jump to the conclusion, however, that there are close relationships between all kinds of human traits. School subjects represent but one field of human endeavor. If athletic ability is considered, it becomes evident that there is not so much relationship between this and scholarship. No athletic coach would pick his team on the basis of school grades. It is true that many good athletes are also good students, but there is probably little more than a chance relationship between athletic success and scholarship.

In the everyday affairs of life, differences in abilities become apparent. Men differ on vocations and occupations. Some men succeed in one job after failing in another. This may occur when the amount of ability required is no greater in one position than the other. The difference may be due to the kind of ability required, the amount of training necessary, one's interest in the job, one's health and strength, or to many other factors. Whatever the cause or causes, men do differ in their success in the practical problems of everyday life. It is for this reason that vocational selection and placement are so important.

## Differences in Intelligence Between Individuals

A strictly logical presentation of the differences in intelligence between individuals would tend to follow the same order as the differences in intelligence within an individual. That is, we would start with the differences between people at birth and trace these differences through the various periods in life. In general, this is the outline that will be followed. However, such a plan encounters the practical difficulty of a lack of significant information on certain topics. For example, we are confronted with the fact that very little is known about the differences between newborn infants. Gesell[19] has given us much of what we know about this subject, but there is always the problem of securing typical forms of behavior from infants and then of finding satisfactory measures for that behavior.

**Rate of growth in intelligence.** With regard to the problem of the comparative growth of intelligence in different children, the evidence is clearer. A good many surveys have been made of preschool and school populations of different ages, many of which have been summarized by Thorndike[20] and Pintner.[21] All this evidence tends to support and elaborate the evidence collected earlier by Terman,[22] which indicates that intelligence at any age takes the form of a normal distribution. However, Terman's distribution was obtained with American-born white children and does not contain a large enough percentage of children of low mentality to be representative of the country as a whole. Certainly for any large typical group at any age, the I.Q.'s will range from near zero up to almost 200. This means, for example, that for six-year-olds the average mental age is six, the range extending from an I.Q. of practically zero up to an intelligence level of about twelve years.

If the distribution is essentially the same for each age, as is gnerally assumed,[23] then the relative difference between children of different ages remains the same. This is the general assumption underlying the concept of the I.Q. However, there is an increase in the actual difference. This difference reaches its maximum in adults, for whom the scale of abilities ranges from near zero up to a

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[19] Gesell, Arnold, *The Guidance of Mental Growth in Infant and Child,* New York, Macmillan, 1930.

[20] Thorndike, E. L., Bregman, E. O., and Cobb, M. V., *The Measurement of Intelligence,* New York, Teachers College, Columbia University, 1927.

[21] Pintner, R., *Intelligence Testing,* new edition, New York, Holt, 1930.

[22] Terman, L. M., *The Measurements of Intelligence,* Boston, Houghton Mifflin, 1926. Also Terman, L. M., and Merrill, Maud A., *Measuring Intelligence,* Boston, Houghton Mifflin, 1937.

[23] Freeman believes that the variability in the scores of children from age to age remains relatively constant. However, he summarizes some evidence indicating that the coefficient of variability may become

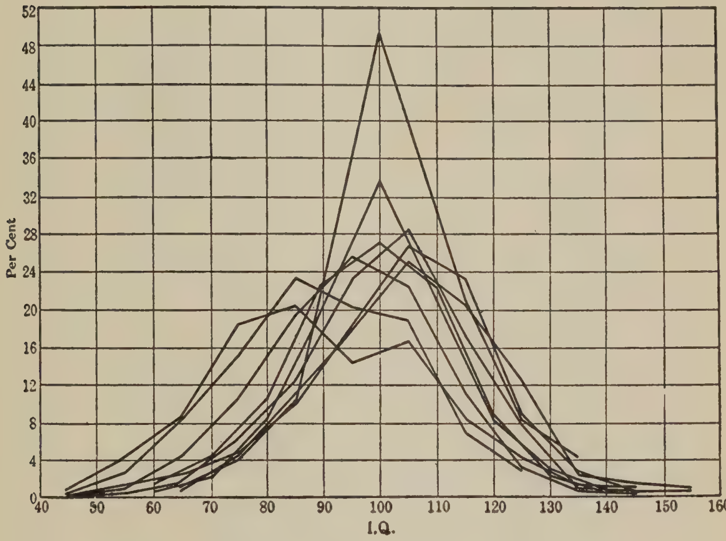

**Fig. 29.**—Percentage Distribution of I.Q.'s from Nine Different Studies of School Children. (Reproduced by permission of the publisher from Pintner, Rudolph, *Intelligence Testing,* New York, Henry Holt, 1931.)

mental age in the neighborhood of a hypothetical thirty-two years.[24] As has been stated before, this gives only

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smaller as we pass upward from the earlier years to about the age of ten, after which it becomes constant. See Freeman, F. N., *Mental Tests,* New York, Holt, 1926, pp. 349–353.

[24] This is spoken of as a "hypothetical mental age." The Binet tests are limited at the upper end, and the highest possible mental age obtainable on the test is twenty-three and five sixths years. If adults vary as much in relative ability as children, an I.Q. of 200 would give a mental age of thirty-two years for adults. Of course, a value such as this is rather meaningless.

a *relative* method of comparing individuals or groups with other groups.

**Age of mental maturity.** There is the related problem of the age at which mental maturity is reached. This has already been discussed in an earlier part of this chapter. It was pointed out there that there are great differences between individuals in the age at which they reach their limit of mental ability. This age may vary from fourteen to twenty or twenty-five.

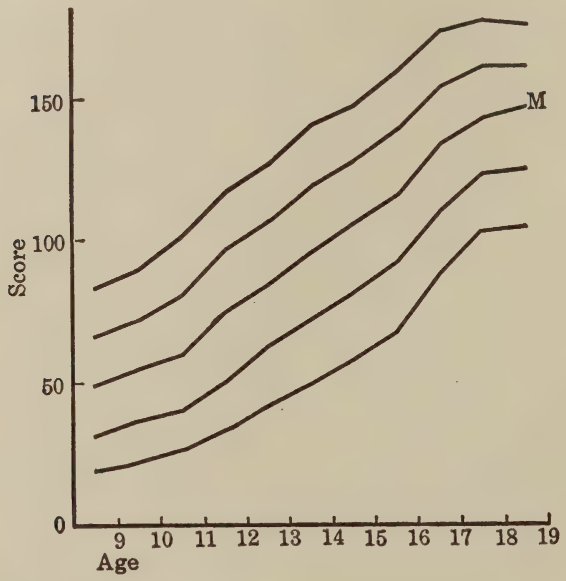

**Fig. 30.**—Age Curves of 25,226 Children in the Otis Group Intelligence Scale, Advanced Examination, Showing the Median (M) and the 10, 25, 75, and 90 Percentiles. (An I.Q. of 25 percentile at 12 years is 10/12, or 83.5, and at 16 years it is 14/16, or 87.5. In the Stanford Revision it is 92. Reproduced by permission of the publisher from Freeman, F. N., *Mental Tests,* Boston, Houghton Mifflin, 1926.)

Is there any relationship between the amount of mental ability and the age at which development ceases? Some have held that, on the average, bright pupils continue to develop longer than dull pupils. Others have held that dull pupils grow less rapidly but for a longer period, thereby partially overcoming their handicap. Freeman,[25] in a study of this problem, finds no difference in the age at which bright and dull children reach maturity. There are differences in the rate of mental growth between members of bright and dull groups, but no significant differences between the average age at which each group reaches its maximum growth.

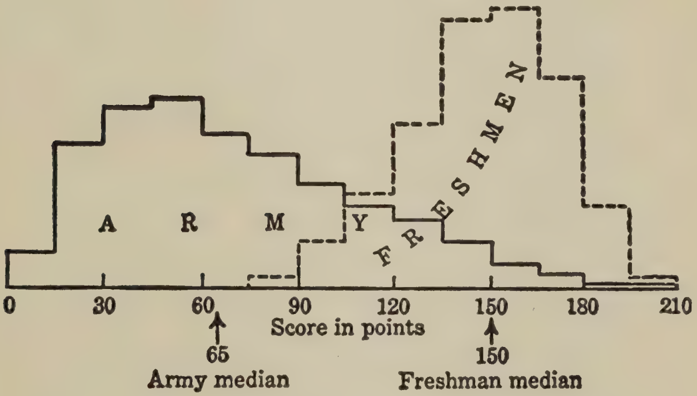

Fig. 31.—Distribution of the Scores of Drafted Men and of College Freshmen on the Alpha Test. (The height of the broken line above the base line is made proportional to the per cent of the group that made the score indicated just below the base line. Reproduced by permission of the publisher from Woodworth, R. S., *Psychology,* New York, Henry Holt, 1929.)

**Differences in mental abilities.** This problem has already been discussed incidentally in an earlier section of this chapter. It was stated there that probably about the same kind of variation is to be found among adults as in the earlier ages but that, if there is any difference, the actual amount of variation is greater in adults.

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[25] Freeman, F. N., *Mental Tests,* Boston, Houghton Mifflin, 1926, pp. 346–348.

The most extensive study of mental ability ever made was with adults. One and three-quarter million men were given the Army Alpha test during the World War. The preceding graph presents a summary of the results of this study. The range on Army Alpha is from 0 to 212, which is practically the range of the scores that were obtained. The average score was 67. The distribution has a distinctly positive skew. This skewness does not necessarily mean that the distribution of mental ability is not normal;[26] it means that the majority of the questions in Army Alpha were too difficult for the average army recruit.

None of these data tells us anything about the extent of differences between adults. This difficulty is due in part to the fact that the units of the scale are not all the same size. We do not know, for example, whether it is more or less difficult to increase a score from 20 to 21 than it is to increase it from 200 to 201. It is almost certain that the units are not the same all along the scale.[27] Therefore we cannot say that a score of 120 is just twice as far from a zero score on the test as is 60. If each successive score above 100 represents greater increments of ability than do the lower scores, then 120 may represent much more ability than would be supposed. In spite of the inadequacy of tests for determining in any precise way the relative abilities of people, they do enable us to rank in approximate order and at times to define the levels of abilities required for certain types of work.

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[26] Thorndike has collected evidence which leads him to believe that there is not a normal distribution of adult intelligence, but the evidence is too complicated to present here. See Thorndike, E. L., *et al., op. cit.,* Appendix VI.

[27] There is also the difficulty of determining the absolute zero (see Chapter III).

Binet scores in terms of mental age or I.Q. have somewhat more meaning, in that they can be directly compared with the scores of other people. On the other hand, as pointed out in an earlier part of this chapter, the Binet scale has little value in the upper part of the distribution for adults. The highest score possible for adults is a mental age of twenty-three years and ten months, or an I.Q. of 152. Because of this fact, we cannot measure the intelligence of superior adults with the Binet scale. The lower half of the distribution for adults can be measured and compared with the scores for children of different ages. However, this has never been done on a large scale. Several special groups, like those in institutions for the feeble-minded and for criminals, have been given the Binet tests. But we must know the proportion of low-grade intelligence to the total population in order to construct a distribution curve. It has often been assumed from Terman's data that about fourteen per cent of the population has an I.Q. between 80 and 89, five per cent an I.Q. between 70 and 79, and one or two per cent an I.Q. below 70. In terms of mental age, this last group would fall below 11.2 years ($16 \times .70 = 11.2$).

Another method used to determine the amount of mental retardation was that of transmuting Army Alpha into mental-age scores. The Army Alpha test was given to a group of high-school pupils, who were also given the Binet test. From these results, a table was constructed for transmuting scores from one test into scores of the other. By this method, thirteen per cent of the recruits in the Army were found to have an I.Q. below 70.

About one per cent had an I.Q. below 40—that is, a mental age of 6.5 years or below. In terms of school accomplishment, it means that one or two per cent of the population will never have the intelligence to get beyond the first grade in school and 13 per cent can never go beyond the sixth grade.

What are the facts? One estimate places two per cent of the population and the other places thirteen per cent in the group having an I.Q. of 70 or below. This is a wide difference. Anyone who had anything to do with the testing, as the writer did, knows that the tests were often given under most unfavorable conditions. Sometimes the recruits sat on the floor of the barracks without lapboards or any support other than their knees for the test blanks. They often had no idea what the tests were about and had no interest in scoring their best. The test scores are therefore certainly lower than would have been obtained under favorable conditions. Probably the Army test results give too large a percentage of low-grade scores. On the other hand, we suspect that the more common estimate of the amount of feeble-mindedness is too low when the total population is taken into account. Probably a more reasonable estimate is that at least three per cent of the population has an I.Q. below 70. If the distribution is normal, then a like number would have an I.Q. above 130. This problem will receive further consideration in Chapter IX.

**Mental deterioration with age.** We have already considered the fact that, on the average, mental alertness scores for persons over thirty are lower than for persons from sixteen to thirty. The scores become progressively lower for the higher ages. Here we are interested in the age at which deterioration begins with different people and the difference that exists between people during senescence.

On the first question, there is very little evidence. No study of normal adults from year to year has ever been made. We cannot know in a particular individual whether there has been a loss in mental ability without knowing what the maximum ability once was and what the ability is at some later time. It is fair to assume, however, that there are important differences between individuals as regards the onset and rate of progress of senescence. From casual observation, it seems likely that some people begin to lose their mental vigor at least by thirty. Others seem to retain their alertness to a ripe old age. Chauncey Depew and Judge Oliver Wendell Holmes are notable examples of men who retained their mental vigor well into the eighties.

There is more information concerning the differences between individuals in later maturity. Table XXXIII on page 262, after Miles and Miles, gives the sigma of the distributions for each five-year period. It is evident from a study of this data that the extent of the distribution of mental alertness scores for the later years is about the same as for the earlier years. Since the median scores are less for these years, the proportion of the sigma of the distribution to the median is actually greater in the later years. This may be a chance tendency, but it is more likely an indication that some old people deteriorate considerably more than others, thereby causing a greater scattering of scores in old age.

### Cultural and Other Environmental Factors in Intelligence

Thus far we have discussed the distribution of intelligence for the total population. When everybody is included or when a small group is selected that is typical of the total group, distributions such as those we have been discussing are obtained. But society is often

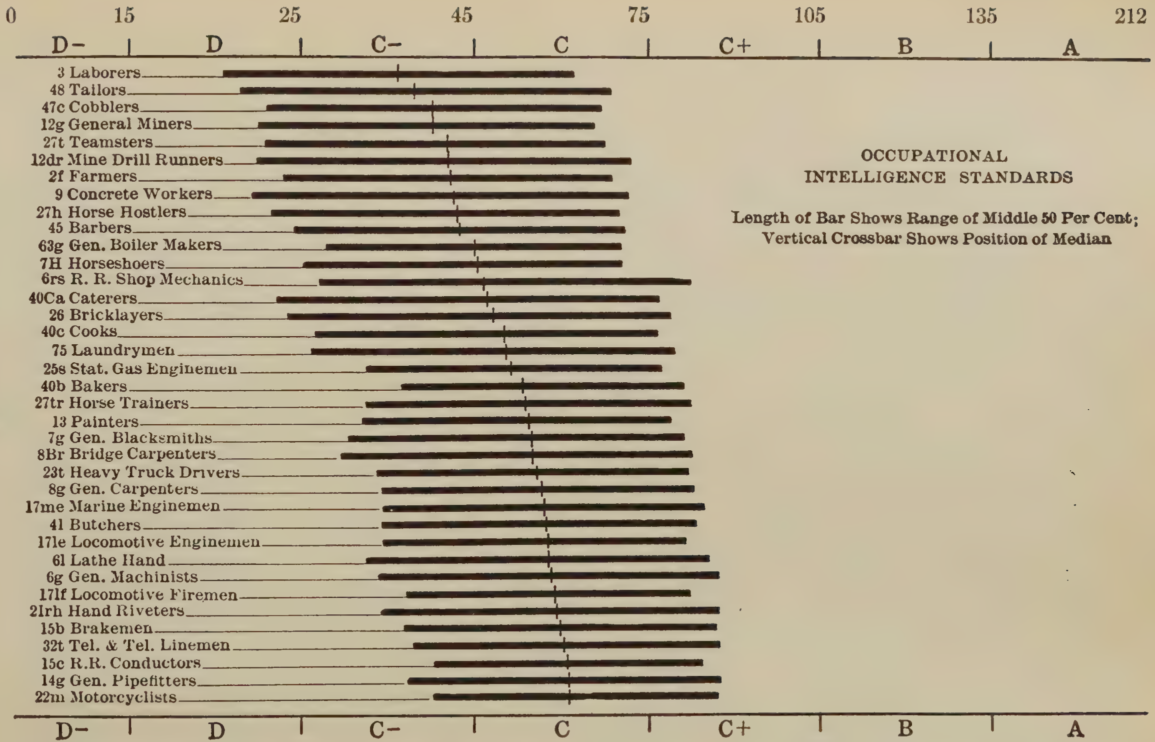

**Fig. 32.**—Graph Showing How Occupational Groups in the United States Differ in Response to Intelligence Tests. (Note wide differences in central tendency, but note also overlapping in range of intelligence among occupations. Reproduced by courtesy of the United States Surgeon General's Office, Washington, D. C.)

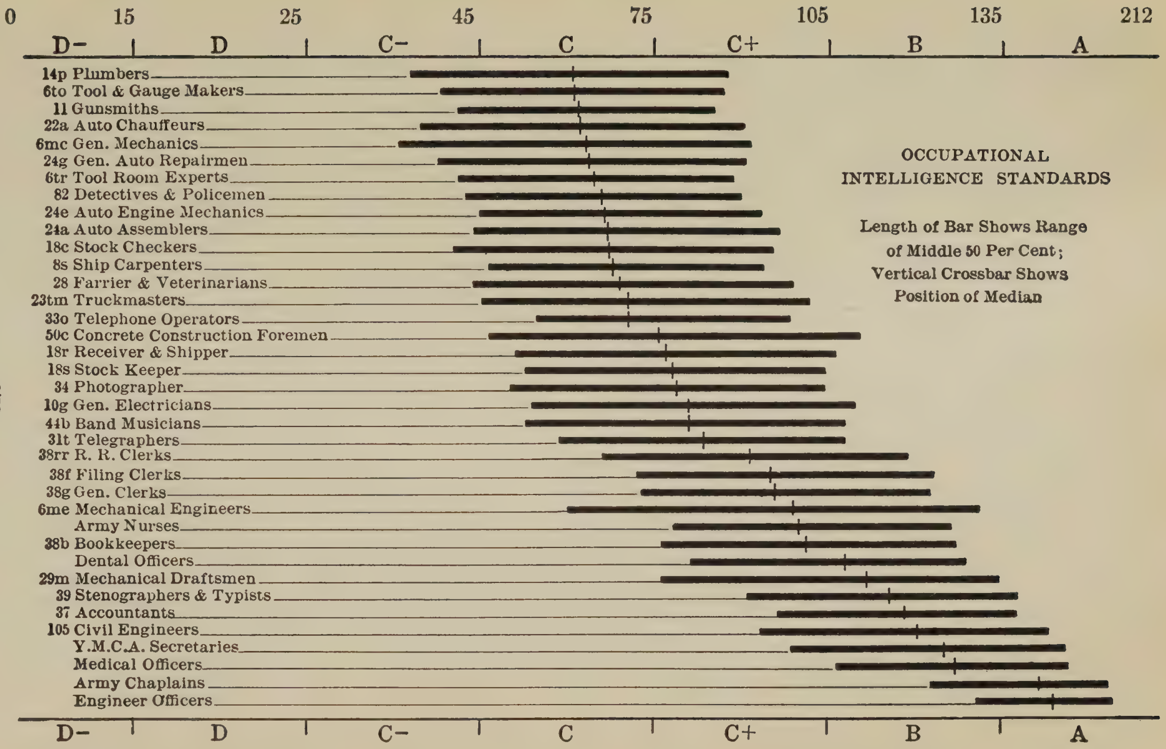

**Fig. 32.**—Graph Showing How Occupational Groups in the United States Differ in Response to Intelligence Tests (*Cont.*)

broken up into smaller groups, which are more likely not to be typical. Let us consider some of these smaller groups and discover as far as possible the effects of different environmental influences upon intelligence.

In Chapter V, it was pointed out that there were often consistent differences between scores for boys and girls on intelligence tests. A survey of these differences disclosed that, for the most part, the differences were due to the tests rather than to any inherent difference between the sexes. Boys do better on tests in mathematics, abstract reasoning, and the kind of information in which boys are interested. Girls do better on tests containing a large language element. But no real differences in general ability between the sexes are evident.

In Chapter VI, many differences were found between the intelligence scores for different races. While it was made clear that the greatest difference was in the *range* in intelligence for any race, nevertheless, consistent differences were found between some racial groups. An examination of the causes of these differences, however, brings out the fact that it is well nigh impossible to determine whether the differences are due to innate factors or to environmental influences. The cultural background of a typical Polish child, for example, is so different from that of an ordinary American-born child that we cannot be sure whether differences in intelligence test scores are due to these cultural differences or to some fundamental inherent differences. There has never been an extensive study of differences between whites and Negroes in which cultural backgrounds have been fully equated. Furthermore, as has been mentioned elsewhere, tests have generally been conducted and standardized on native-born white children. It is conceivable that some kinds of tests could be constructed that were based upon the experiences of other than native-born whites and that would place most white children at a disadvantage. Not only are differences found between races but between different cultural and socio-economic groups within races. Such differences have been found between native-born white children and between adults.

One of the earlier studies consisted in an analysis of Army Alpha scores of the World War draft, on the basis of occupation. The preceding diagram gives the median and interquartile range (middle 50 per cent) for 18,423 soldiers classified into occupational groups. For example, barbers averaged 58, the middle 50 per cent ranging in score from 37 to 83. In contrast, civil engineers averaged 117, the middle 50 per cent ranging from 99 to 143. This early study showed significant differences in intelligence between various occupational groups.

Several extensive surveys of children have classified intelligence scores on the basis of the occupation of the parents. One of the most extensive of these was made by Haggerty and Nash,[28] in the State of New York. They tested 6,688 elementary and 1,433 high-school pupils by means of the Haggerty-Miller group mental tests. The same proportion of children were tested in each of the occupational groups as were found in these groups by the federal and New York State occupational surveys. The percentages for the various groups were about 5 per cent for the professional group, 14 per cent for businessmen and clerical workers, 15.5 per cent for skilled laborers, 8 per cent for semiskilled laborers, 46.5 for farmers, and 11 per cent for unskilled laborers. The following graph shows the median scores and middle 50 per cent for the various occupational groups. This graph gives further proof that there are significant differences between the various groups.

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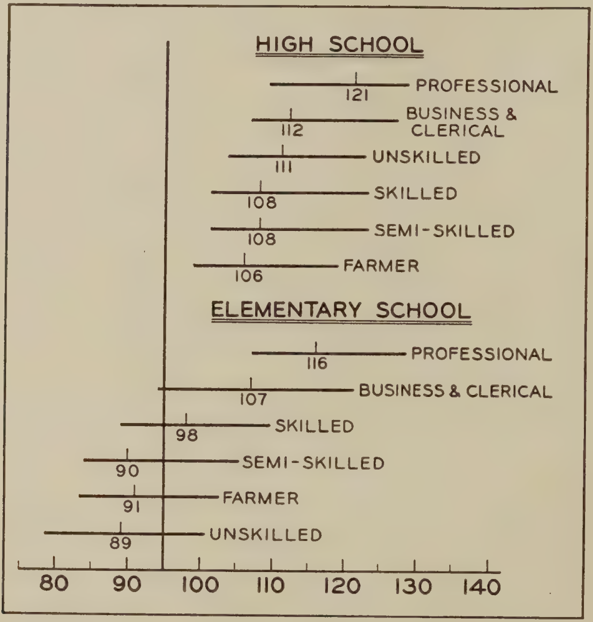
[28] Haggerty, M. E., and Nash, H. B., "Mental Capacity of Children and Parental Occupation," *Journal of Educational Psychology,* Vol. XV (1924), pp. 559–572.

In the last revision of the Binet tests, Terman and Merrill[29] also classified the children they tested according to the occupation of the fathers. Table XXXVI gives the mean I.Q.'s for each class. Like other similar studies, significant differences are shown here between the different occupational groups. This study does not show as large differences as some of the others because



*After Haggerty and Nash*

Fig. 33.—Median I.Q.'s and Range of Middle 50 Per Cent for 1,433 High-School and 6,688 Elementary-School Pupils, Arranged According to Father's Occupation.

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[29] Terman, L. M., and Merrill, Maud A., *Measuring Intelligence*, Boston, Houghton Mifflin, 1937.

only native-born white children were used as subjects, which eliminated many children whose parents would have been in the lower occupational groups.

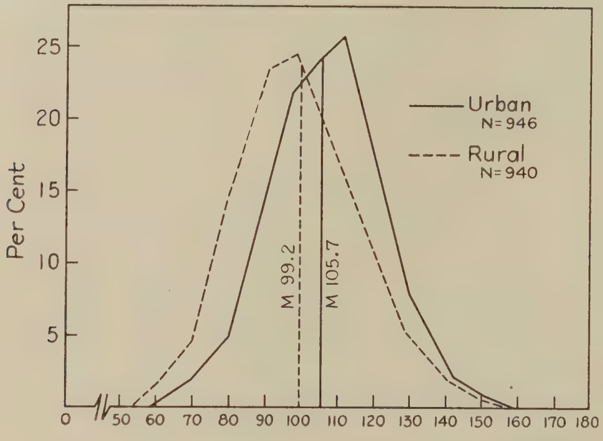
Several comparisons have been made between urban and rural children. Terman and Merrill classified the children they tested in this manner. The urban group was defined to include all subjects from areas where the density of population was 1,000 or more per square mile. The median I.Q. was 105.7 for the urban group and 99.2 for the rural group.

TABLE XXXVI

Mean I.Q.'s of Children Classified According to Father's Occupation

| *Father's Occupational Classification* | *Mean I.Q.* | | | |
|---|---|---|---|---|
| | *Age 2 to 5½* | *Age 6 to 9* | *Age 10 to 14* | *Age 15 to 18* |
| I. Professionals | 116.2 | 114.9 | 117.5 | 116.4 |
| II. Semiprofessionals | 112.4 | 107.3 | 112.2 | 116.7 |
| III. Clerical workers and skilled laborers | 108.0 | 104.9 | 107.4 | 109.6 |
| IV. Rural owners | 99.1 | 94.6 | 92.4 | 94.3 |
| V. Semiskilled laborers | 104.3 | 104.6 | 103.4 | 106.7 |
| VI. Slightly skilled laborers | 95.1 | 100.0 | 100.6 | 96.2 |
| VII. Day laborers | 93.6 | 96.0 | 97.2 | 97.6 |

Interesting as all these comparisons are, they tell us little about the innate differences between the groups studied. The children from the lower economic classes lack the cultural and often the educational advantages of the higher economic groups. Until some controlled study is conducted in which the environmental factors are held constant for the different groups—which would be extremely difficult, if not impossible—we will not know whether the differences are innate or acquired, or rather, how much of the difference is due to heredity and how much to environment. However, if intelligence is defined, not as the innate capacity to learn or to reason, but as the composite of innate, cultural, educational, and environmental factors, then the differences just studied may be considered as differences in intelligence. There is much to justify such a working definition of intelligence.



*After Terman and Merrill*

**Fig. 34.**—Distribution of I.Q.'s for a Group of Urban and Rural Children.

### Exercises

1. What is the *g* factor in Spearman's theory of intelligence? Give Thurstone's multiple-factor theory.

2. By what method did Thurstone and Ackerson come to the conclusion that intelligence begins to develop two or three months before birth?

3. Explain how a disproportionate number of easy questions in a mental test would tend to indicate that mental growth follows a negatively accelerated curve.

4. How has the use of *mental years* to express the results of mental tests affected concepts of the nature of mental growth?

5. When is mental maturity usually reached? Give one reason why the precise determination of this point is relatively unimportant?

6. To what extent can the achievements of the first fifteen or eighteen years of life be considered as an indication of later adult intelligence and achievement? How it this question related to that of the constancy of the I.Q.?

7. Why do we not accept at face value test results in studies of older people, even though these results coincide with the common observation that mentality declines with advancing age?

8. Describe the probable form of the curve of mental growth and decline for the average person who has reached eighty years of age.

9. Why do the data of Table XXXIII not indicate that all people reach the same low level at seventy-eight years of age? What evidence is there that some people are as capable at seventy-eight as others are at eighteen? What relation exists between age and variability in these data?

10. Give several reasons why older people are usually less efficient in learning than younger ones.

11. What reasons can you give for the high correlations between school grades in different subjects (see Table XXXV)?

12. What differences exist among individuals in intelligence? What kind of a distribution would you expect from a very large representative sampling of one age?

13. Do people differ in respect to the age at which mental maturity is reached? What correlation did Freeman find between the age of mental maturity and the level of intelligence?

14. What are some of the characteristic differences in I.Q. of children whose parents belong to different occupational groups? To what may these differences be attributed?

15. Give two reasons why an intelligence test score of 60 cannot with confidence be said to represent twice as much ability as one of 30.

16. Give examples from studies and personal observation of test scores which have been made rather low by poor cultural and educational advantages.

17. What type of skewed distribution would you expect to get from tests given to a large group under very unfavorable conditions?

18. Mention some men whose biographies suggest that they reached mental maturity at a relatively late age. What facts in their lives indicate late maturity?

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## CHAPTER IX

# Types of Extreme Deviations

There is a tendency to set some men apart and to consider them different from other men. Thus Plato, Socrates, Aristotle, Descartes, Newton, and Einstein are considered great scholars; Cyrus, Alexander the Great, Julius Caesar, Charlemagne, Frederick the Great, and Queen Victoria, great rulers; Commodore Vanderbilt, Baron Rothschild, Andrew Carnegie, and John D. Rockefeller, great financiers or industrialists. The list might be extended indefinitely. Are these great leaders in their respective fields essentially different from other men or are they only the extremes of unnumbered multitudes of men of varying degrees of lesser ability? Do such men constitute distinct types or are they merely endowed with more of the same kind of ability to be found in ordinary men? This is a problem of more than theoretical interest.

The older psychology contained numerous illustrations of the classification of men into types. A common example of this was the division of people into imaginal types, such as audiles—those who supposedly recall what they remember through sound—and visuals—those who recall in visual terms. A more modern example is the analysis of personality types into introverts and extroverts. Such classifications into types were no doubt a natural outgrowth of the faculty psychology of a generation or two ago. Another relatively recent attempt at classifying people into types was made by Berman.[1] His classification is based upon endocrine control. According to him, personality types depend upon endocrine balance or imbalance. Berman explains the success of various characters in history in terms of the endocrine glands. Thus, for example, Napoleon is said to have been a great general because he was thymocentric, with a pituitary deficiency; Oscar Wilde's genius is explained by the fact that he was a pituito-adrenal-centered individual; and Florence Nightingale's personality is said to have been completely changed at the age of thirty-two by a shift in endocrine balance.

Type psychology as such has been largely discarded by modern students. This has come about by the discovery that, in most psychological functions, people are not separated into distinct groups. In the study of imagery types, for example, it has been found that most persons belong to what are called "mixed" types. Only rarely, if ever, is a person a pure audile. He may sometimes recall in predominantly auditory imagery, but at other times he may recall in visual, kinaesthetic, or verbal terms. When any trait is measured by a reliable scale, it has generally been found that testing any large unselected group of people results in a normal distribution. This holds whether the trait is a physical one, like height, or a mental trait, like intelligence. For example, as shown in a previous chapter, men tend to average about 68 inches in height, with fewer and fewer at the extremes of about 30 inches at one end of the distribution and 100 inches at the other. In other words, the facts indicate that people are not separated into distinct groups or types. In any physical or mental trait they tend to cluster around some central tendency, with fewer and fewer cases at the extremes and no gaps in the distribution. This holds especially for simple or unit traits and, to a lesser extent, for complex or compound traits. Such evidence discredits the old notion of distinct types.

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[1] Berman, L., *Glands Regulating Personality,* New York, Macmillan, 1928.

Nevertheless, there is a certain advantage in having a term to apply to the extreme cases in any distribution. When we want to designate the lower and higher ends of the distribution in intelligence, we speak of the "feeble-minded" and the "geniuses." These are not distinct groups, but they are extremes of the distribution; they are usually considered to be the lowest and highest one or two per cent of the population. As other examples of extremes, we may speak of "tall and short men," "fat and thin men," "honest and dishonest men." There is a certain advantage in having some term by which to designate these extreme cases in any group of men. Since there is no other word with this connotation, the word *type* may be used with this new meaning. The feeble-minded are a type but not a group distinctly set apart. It is a name for those extremely low in intelligence. Likewise the criminal is not so much a man set apart as he is an extreme in the case of law infringement.

With such a definition of *type,* we are confronted with an almost unlimited number of types, both normal and abnormal. This chapter will deal largely with abnormal types. The White House Conference on Child Health and Protection[2] lists the following special classes of children, as types of the physically and mentally handicapped: the crippled, the blind and partially seeing, the deaf and hard-of-hearing, the defective in speech, children of lowered vitality, the mentally retarded, and behavior-problem children. As a treatment of all the various extreme types of human characteristics would extend beyond the scope of this text, this discussion will be limited to a few major types of deviations, such as: (1) the mentally deficient; (2) the insane; (3) the criminal; and (4) persons with major sensory or motor defects.

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[2] *White House Conference on Child Health and Protection,* New York, Appleton-Century, 1931.

## The Mentally Deficient

There are two major types of mental abnormality. One is due to the lack of mental ability. The other is due, not so much to a lack of ability, as to disturbances of the personality or emotional aberrations.

As stated in Chapter VIII, according to a conservative estimate, about two per cent of the population are so mentally retarded that the best of them will never possess the ability much above that of a normal eleven-year-old child. If this percentage is correct, there are from about two to two and a half million such individuals in this country. Moreover, it must be understood that this group includes individuals with mentalities ranging all the way from almost no intelligence up to those with a mental age of eleven years. No one who has not visited an institution for the feeble-minded can appreciate how helpless and pathetic some of these cases are. Many of those of lower mentality can never learn to take care of their own bodily needs. They can neither feed nor clothe themselves; they are little more than helpless masses of protoplasm. Only the best of the group can ever learn to read an ordinary newspaper or to write a simple letter. Yet the majority of them are supposedly responsible members of society, with the full rights of franchise.

For those of this group of school age, there is the problem of what kind of training is best fitted to their needs. Should they be drilled in the fundamentals or should they be given only the minimum essentials in the traditional school subjects and then trained in the manual arts? Should they be kept in school for the normal length of time or let out sooner to seek employment? For what kinds of employment are such persons fitted? Most of them are prepared only for unskilled or semiskilled labor. In normal times, there is room and need for large numbers of this type of workmen. In times of economic stress, however, these are the first to be let off to become wards of the state. Even in normal times, this group is most often subject to exploitation. They live near the border line of economic ruin. Competition is keen, and they do not have the ability as individuals to further their own best interests. Furthermore, there is not sufficient organization in their ranks to protect them from all kinds of injustice and oppression.

Those with somewhat more ability or those who have had sufficient training in routine work are likely to have a better lot. There are thousands of men who come within the limits of the mental group under discussion who make faithful, efficient laborers. They are numerous among the men who run our mills and factories, and who serve the public in many routine ways. A danger that besets the whole group arises from their inability to make wise decisions in managing their personal and home life. High-pressure salesmen can sell them, not only all kinds of gadgets, but also worthless stocks and bonds, on time. They buy what they do not need at the expense of the real necessities of life. They are led by any leader, political and otherwise, who make all sorts of extravagant promises to them. They are attracted by this fad and that. If the leadership happens to be good, the results are favorable; but if it is bad, the results are disastrous.

What can be done about all these people? Must we provide leadership for them; must they be regimented? Indeed, that would be one way of caring for them. Others believe social legislation can do much to help such people. Provisions for a minimum wage, workmen's compensation, unemployment insurance, old-age pensions, and other labor legislation are relatively recent movements to protect and aid the laborer. How he can be skillfully guided in his economic and social life has not been so well determined. But if there is as much progress in this field in the next decade as there has been in the last, we may not have long to wait for at least a partial solution of some of our present difficulties. Yet we must not be too hopeful. Our present social order is a product of centuries; the millenium is not to be expected just around the corner. Even if everybody wanted a perfect social order, there would still be the practical problem of how best to attain it. The defective, the maladjusted, and the delinquent do not present the only obstacles in the way of its attainment. Nevertheless, they do present a real problem now and no doubt will continue to do so for a long time to come.

## The Insane

Another type of mental disorder is presented by the mentally deranged. These people might have the ability to solve the problems of life if they could see them in their true light, but because of some disturbance, they view their problems from a distorted perspective.

**Extent of mental derangement.** As with feeble-mindedness, the number of persons classified as mentally abnormal depends upon the inclusiveness of the definition. As one author has pointed out, practically all of us are more or less abnormal.[3] Of course, only a small percentage of our population is seriously deranged. The last census reports 318,948 inmates of state institutions for the insane. In addition to these, there are about 40,000 in county, city, and private institutions. No doubt there are many more thousands in private sanitoria not enumerated in the census report. Some conservative estimates have placed more than half of 1 per cent of the population of this country in institutions for the mentally abnormal. It should be mentioned that occasionally there are persons in such institutions who do not deserve to be there. It is also true that many others who are not in institutions should be there. Suffice it to say that mental abnormality is no small problem in our modern complex society.

**Treatment of the mentally deranged.** In olden times, it was believed that such persons were possessed of evil spirits. All sorts of torture and even death were meted out to such unfortunates. Later they were placed in institutions ordinarily called "asylums." Here their condition was often pathetic. All sorts of cruel practices and punishments were heaped upon them.

Although considerable study had been made of the problem of the mentally deranged, it remained for Kraepelin, a German psychiatrist, working in the latter half of the nineteenth century, to make the first successful approach to the scientific study of insanity. Kraepelin believed most psychoses were due to heredity or organic causes. By studying symptoms and causes of insanity, he made a classification of types of neuroses. The following are the chief types listed by him: dementia praecox, manic-depression psychoses, paranoia, paresis, neurasthenia, and epilepsy, as well as certain involution, infection, and toxic psychoses. Kraepelin's influence has been profound and has continued to the present day.

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[3] He expresses this well in the preface of his book, as follows: "Is the reader hopelessly perfect? If so, let him close this book. It is not for him. Is he so mentally ill that he requires the careful attention of a psychiatrist? Is so, again, let him close the book. This book is for the rest of us, the in-betweens, the so-called normals." Overstreet, H. A., *About Ourselves,* New York, Norton, 1927.

Important and valuable as Kraepelin's contributions were, he nevertheless neglected the importance of the functional psychoses, which in the final analysis, constitute the great majority of neuroses. There are thousands upon thousands of men and women without serious organic defects who have become maladjusted to their environments, and these maladjustments have often become so serious that these people are severely handicapped in their daily life. Janet and the psychoanalysts were among the first to point out these functional psychoses. Freud and his pupils showed how complexes are formed by the suppression of normal impulses. Using the highly personified terminology of the psychoanalysts, we may say that these impulses are charged with a high degree of energy (libido). These impulses continually try to express themselves. In extreme cases, when expression is suppressed, they may cause a derangement or splitting of the personality. Only by some form of outlet is this condition remedied. In practice, psychoanalysis is a method of determining the underlying causes of complexes and devising methods for reconstructing the personality by a more acceptable adjustment to the problems of life. Whether or not we accept the theory of psychoanalysis, Freud has called attention to the nature of many of our mental maladjustments and suggested one method for their treatment.

Morgan[4] was one of the first to point out the psychological nature of functional psychoses. He showed that mental abnormalities of this type are distortions of normal psychological processes. They are abnormal manifestations of sensory processes—of perception, of memory, of imagination, of the emotional life, and of social adjustments. Since man's most important adjustments are emotional and social, it is reasonable that these are the points of most serious derangement. Men and women develop abnormal ways of meeting their emotional and social adjustments because they are unsuccessful or do not know how to meet them normally. This point of view does not deny that there are organic psychoses—such as paresis, epilepsy, and toxic states—and that these organic conditions may even be a contributing factor to many functional neuroses; but it does maintain that dementia praecox, manic-depressive psychoses, paranoia, hysteria, neurasthenia, and psychosthenia are essentially maladjustments to life problems, and that they should be so considered and treated.

There is as great, if not greater, variation between different forms of psychoses as between normal individuals. For example, in many respects the manic-depressive is diametrically opposed to the dementia-praecox patient. The manic tries to overcome his environment by force, whereas the dementia-praecox patient withdraws from his environment. The neurasthenic and hysterical individual seeks his adjustment through ailments and defenses. Thus the various psychoses represent different unsuccessful attempts of individuals to cope with their environments. Each type seeks by his own methods a way out of his difficulties. It would be interesting to trace in more detail characteristics of the different psychoses, but any extensive discussion of these topics would lead us too far afield. We shall therefore end this discussion with only the brief mention of its relation to the problem of individual differences.

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[4] Morgan, J. J. B., *The Psychology of Abnormal People*, revised edition, Longmans, Green, 1936.

## The Criminal

Another deviation from normality deserving of our attention in this chapter is that presented by the criminal and his acts of crime. The terms *crime* and *criminal* are not easy to define, unless we accept the purely legal definitions that a crime is any violation of law and that a criminal is a person who commits a crime. Simple as these definitions are, there are several reasons why they do not satisfy most social psychologists and sociologists. For example, with the present set of laws and ordinances, especially in the modern city, hardly a week passes in which each person does not, under this definition, commit a crime. We park our automobile in the wrong place; we improperly wrap or place the garbage, burn trash in the alley, or commit hundreds of other acts of omission or commission. There is also the question of whether, having once committed a crime, a person is henceforth a criminal or whether punishment absolves a crime. Is any act, be it ever so repugnant or violent, not a crime so long as it is "within the law"? If a man steals in some novel way not covered by statute, is he not committing a crime? Then there is also the problem of fraud. What is the relation between fraud and crime?

The problem of defining these terms may be further complicated by asking whether a person is really a criminal until he has been convicted of a crime. It remains for the court to determine whether or not a crime has been committed. If this be the definition of a criminal, then the person who has committed an unprovoked murder but who has not been apprehended and sentenced is not a criminal, whereas the person who has parked for sixteen minutes in a fifteen-minute parking space and who has been apprehended and fined one dollar for the offense is, at least at some time during the process, a criminal. Suffice it to conclude that it is next to impossible to give a satisfactory definition of crime. In this discussion we shall use the term loosely to describe a person who commits some major offense against an individual or society.

**Development and classification of crime.** Early man set up his ideas of what should not be done in the form of taboos. Acts that were tabooed were those which he thought brought harm or evil to his tribe. The religious element was always present to a considerable degree. As the Church became dominant as an institution of religion, the concept of sin was substituted for taboos. The political state, in turn, placed emphasis upon the protection of its citizens and their property, and crime came to take on its present aspect.

Crimes have been classified in several ways, one of the most common being in terms of the degree of seriousness. There are usually three types of crime when classified on this basis: treason, felonies, and misdemeanors. Treason, as defined in the Constitution, consists in waging war against the United States or in aiding the enemy. Felonies are serious crimes generally punishable by confinement in a federal or state prison. Misdemeanors are less serious crimes punishable by fines or shorter terms of imprisonment. However, the distinctions between these classes are not clear, varying from one state to another and from one time to another.

**Causes of crime.** During the Middle Ages, it was generally believed that crime was due to innate depravity and that it was the work of the devil. Early in the nineteenth century, the so-called "classical school of criminologists," basing their ideas upon a hedonistic philosophy, believed that crimes were committed because the pleasure a person obtained from committing a crime was greater than the punishment or fear of punishment which resulted from the act. According to this point of view, the way to prevent crime was to provide punishments sufficiently severe to deter people from committing crimes. For each crime a certain penalty was provided, which was to be administered uniformly to all who committed the crime, irrespective of age, social position, or extenuating circumstances.

In the latter part of the nineteenth century, a new doctrine of crime was evolved. Lombroso[5] was one of the leaders of the new school. This school believed that criminality was inherited, that there was a distinct criminal type, and that the criminal could be detected by certain physical stigmata—such as birthmarks, irregularly shaped noses, ears, and so forth. Much evidence was collected to support this point of view, but it was not adequately checked by statistical methods. More recent studies, especially by Goring[6] have shown that stigmata are very little more common among criminals than others and that criminality cannot be explained or predicted on the basis of physical defects.

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[5] Lombroso, C., *Crime, Its Causes and Remedies,* Boston, Little, Brown, 1911.

[6] Goring, Charles, *The English Convict,* London, Darling, 1913.

Early in the twentieth century, Goddard[7] and others attempted to show that criminality was caused largely by low mentality. Many studies showed a high percentage of feeble-minded individuals in penal institutions. Later studies, however, as summarized by Murchison,[8] have shown that, while a large percentage of mentally inferior people do inhabit our penal institutions, the percentage is not higher than that of the corresponding types of society outside the prisons. When penal groups were compared with the Army test records in corresponding areas, the curves and distribution were strikingly similar. This indicates that feeble-mindedness is not the major cause, at least not of a large percentage, of crime.

More recently, certain sociological and psychological causes of crime have been propounded. Sutherland,[9] for example, believes that crime is due to the lack of consistency and harmony among the influences which direct the individual. To him, a conflict of cultures is the fundamental principle in the explanation of crime. In relatively stable communities, such as were found in China until recently, practically everybody abides by the customs and laws of the country. In the United States, on the other hand, many cultures have come into contact with one another. It is under such a condition that crime is prevalent. As Shaw[10] has shown, the points of contact between different cultures in our cities are the areas where crime is most prevalent. Gault[11] has emphasized the psychological factors in crime. The most common explanation of crime from his point of view is the formation of criminal habits. People learn to be criminals; they begin by committing petty crimes, and gradually become more hardened as well as more expert. Other reasons for delinquency are personality disorders, home maladjustments, emotional disorders and other pathological conditions. When we come to look upon crime as due to bad habits, which are learned just as any other habit is learned, and realize that the criminal is in a sense a diseased person, our method of prevention and treatment of crime will improve.

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[7] Goddard, H. H., *Feeblemindedness: Its Causes and Consequences,* New York, Macmillan, 1914.

[8] Murchison, Carl, *Criminal Intelligence,* Worcester, Massachusetts, Clark University Press, 1926.

[9] Sutherland, E. H., *Principles of Criminology,* Philadelphia, Lippincott, 1934.

[10] Shaw, C. R., *Delinquency Areas,* Chicago, University of Chicago Press, 1929.

[11] Gault, R. H., *Criminology,* New York, Heath, 1932.

**Cost and extent of crime.** Various guesses have been made as to the cost of crime. It has been claimed that crime, either directly or indirectly, costs our country ten billion dollars per year. This statement would be hard to prove or disprove. One estimate places the cost of the detection, conviction, and care of criminals at between five and ten cents of every dollar collected by taxation. Crime ranks with education as one of the two largest factors in the total tax budget.

Statistics regarding the extent of crime are equally unreliable. One approach to the problem is through the number of crimes reported to the police. Another is through the number of convictions. If all minor misdemeanors—such as violations of automobile-parking ordinances—are included, the number is very large indeed.

There are about 185,000 prisoners in our state and federal prisons. This is at the rate of more than 140 to every 100,000 of the total population. Nor does this number include the thousands of inmates of city prisons and county jails. The number of prisoners increases from year to year. We have a relatively larger prison population than any other large country in the world.

Our preëminence applies to almost all kinds of crime. For example, Chicago has about 400 murders annually; this is fifteen to twenty times more than for similar cities in Europe. Figures obtained in other large American cities are much like those for Chicago. Even suicides average fifteen or more per hundred thousand of the population in this country, or nearly twice as high as in England.

There are, no doubt, several reasons for this prevalence of crime in our country. The many sociological and psychological causes of crime are important. That is, there are many cultural conflicts as well as many personal conflicts in American life. The economic urge is strong, and people are motivated to obtain wealth by any means. Our legal and penal systems have been too much under the control of politics, and we have only begun the scientific training of our police. These and other causes no doubt account for our unenviable record in crime.

### Sensory and Motor Defects

Any sensory field can be defective. Cases of anosmia, or loss of smell, are uncommon but not unknown. Loss of taste, except for a brief time, is less common. The kinaesthetic and cutaneous senses are sometimes impaired and rendered inactive by disease and certain drugs. Especially pain is reduced or even destroyed temporarily by local or general anaesthetics. However, the two senses whose impairment or loss is most serious, as well as most common, are those of sight and hearing.

**The deaf and hard-of-hearing.** The last census gave the total number of deaf and dumb in the United States as 57,084. This represents nearly one twentieth of one per cent, or five hundred out of a million persons.

The above figures represent the totally or almost totally deaf in our population. Although numerous surveys have been made, there is no general agreement about how many people have hearing defects of various degrees of severity. The most common procedure in trying to answer this question has been to establish a standard and consider anyone with a hearing defect below that limit as hard of hearing. This standard has usually been set at nine sensation units. Hearing loss is expressed in terms of sensation units by means of the following formula:

$$\text{Hearing loss} = \frac{10 \log \text{necessary sound intensity for the subject}}{\text{Sound intensity for normal subjects}}$$

This can be illustrated as follows: a person with nine sensation units loss can hear at only ten and a half inches what the normal person can hear at thirty inches.[12]

In 1928, a joint committee of the National Educational Association and the American Medical Association decided, after a careful survey, that ten per cent of the population have a hearing defect of nine sensation units or more. By the use of the phonograph audiometer in several extensive surveys, later workers have generally found hardly half this amount of serious hearing defects. If we accept these more conservative figures, it would mean that there are in the neighborhood of from four to five million people in this country with rather serious loss of hearing.

While there have been many surveys of hearing conducted in the public schools, apparently none of these has been looking for children of superior ability in hearing. The question arises as to whether hearing ability is distributed according to the normal probability curve—that is, are there as many people with superior hearing ability as there are those who are defective? It seems likely that human defects produce a skewed curve, with a loading at the lower end.

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[12] For a further discussion of this problem, see Fletcher, Harvey, *Speech and Hearing,* New York, Van Nostrand, 1929, pp. 198–221. Also Madden, Richard, "The School Status of the Hard of Hearing Child," *Columbia University Contributions to Education,* No. 499 (1931), pp. 15–18.

The approximately 57,000 deaf people in this country present a serious educational problem. Of this number more than one third are under twenty years of age. Most, if not all, of them are or should be in special schools. The problem of the education of the deaf is a difficult one. This is especially true when deafness is congenital. Anyone who has had anything to do with the education of the deaf or even has heard the congenitally deaf child try to talk can realize what a serious problem in education they present. Cut off, as the deaf person is, from one of the two main avenues of approach to his environment, he must learn to compensate by the use of other senses. The usual substitute sense, of course, is vision, except in cases like those of Laura Bridgman and Helen Keller, in which vision is also lacking. The second and third most important substitute senses are touch and kinaesthesis.

The method of educating the deaf has been a subject of much controversy. Two main schools of thought have developed, one favoring the sign or manual method and the other the lip-reading method. As someone has said, it has often appeared that the real problem of educating the deaf has been lost sight of in the heat of the debate over these two methods. It is hard to compare the merits of the two methods, since we can never be sure about the relative abilities of the groups that have been trained by either one.

Pintner and Paterson[13] were the first to become seriously interested in the intelligence of deaf children.

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[13] Pintner, R., and Paterson, D. G., "Some Conclusions from Psychological Tests of the Deaf," *Volta Review,* Vol. XX (1918), pp. 10–14.

These investigators found that the usual intelligence tests were not applicable to the deaf. They were therefore forced to construct a test entirely without language requirements. Using such tests, they found that, on the average, the deaf child has a mental age of two or three years below that of the normal-hearing child. Later work in England[14] and in this country[15] has raised some doubts as to whether the defect is as great as this when all language factors are removed from the tests. It seems reasonable to suppose that this is essentially true, provided intelligence is defined in terms of the capacity to learn. In ordinary life situations demanding oral language, the deaf are handicapped. Because of this, they probably do not acquire as wide an experience with their environment as hearing persons. In any test of knowledge, the deaf are deficient; in native capacity to learn however, as long as the cause of deafness has not also caused wider bodily impairment, the deaf are very likely not much inferior to the hearing. In educational achievement, the deaf child has seldom attained a place commensurate with his mental age. As has been stated, Pintner and Paterson found that the deaf child was from two to three years retarded mentally. But Pintner[16] found that such children are from four to six years below normal in educational attainment.

A study has recently been made[17] of the personality traits of the deaf child. While the study was subject to the limitations of the questionnaire method, the results come to the very reasonable conclusion that the deaf are almost as attentive as are hearing children of the same level. They obey with the same degree of promptness as other children and are not different either in conduct or discipline. However, they were never rated as leaders, while one fifth of the normal children with whom they were compared were so rated. Shyness and solitariness were found more common among the hard-of-hearing. The deaf child is likely to think that he is being laughed at when others are talking and laughing around him. This occasionally makes him suspicious and irritable. More often, as has been suggested, the deaf child withdraws from the social group and becomes introverted.

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[14] Drever, James, and Collins, Mary, *The Teacher of the Deaf,* Vol. XXVII (1929), pp. 163–167; and *Performance Tests of Intelligence,* Edinburgh, Oliver and Boyd, 1928.

[15] MacKane, Keith, A Comparison of the Intelligence of Deaf and Hearing Children," *Columbia University Contributions to Education,* No. 585 (1933), pp. 1–47.

[16] Pintner, R., "A Mental Survey of the Deaf," *Journal of Educational Psychology,* Vol. XIX (1928), pp. 145–151.

[17] Madden, Richard, "The School Status of the Hard of Hearing Child," *Columbia University Contributions to Education,* No. 499 (1931), pp. 1–64.

The amount of intellectual, educational, and social retardation of the hard-of-hearing is largely a function of the amount of deafness. Obviously a person with only a very slight hearing defect is not as a rule seriously affected by this loss, unless he becomes obsessed by the handicap. On the other hand, a person almost totally deaf may be nearly as handicapped as the totally deaf. It should be pointed out that the time at which deafness occurs, if it is serious, is an important factor in its effect on the person so afflicted. If a child is congenitally deaf or so hard of hearing that he cannot hear the common conversations round about himself, he will be deprived of the opportunity to learn to speak and will remain without adequate means of communication, unless taught to speak either by means of the lips or hands. Furthermore, such a child cannot be made to understand without being taught either lip-reading or the sign language. Even the problem of reading is much more difficult for the deaf and seriously hard-of-hearing. The usual cues for the motivation of learning, as well as for teaching, are lacking in such persons, with the result that a situation arises calling for special instruction. Hence the deaf and seriously hard-of-hearing need to be trained in special schools. Such training is provided by most large city schools in special classrooms and by many private day and continuation schools. However, much yet remains to be done in the way of adequate training for many of these handicapped children. The less seriously handicapped may be trained in the regular classes in school. But they must receive special attention, such as being seated in the front of the classroom and given careful medical attention, or they will lose out in school competition. Studies of school failures and behavior-problem cases show an undue proportion of physical defects, but often, when the causes of the defects have been remedied or provided for, these children make satisfactory school adjustments.

In closing this discussion, mention should be made of the very common loss of hearing among old people. The incidence and extent of such hearing loss is not known. It is generally taken for granted and little or nothing done about it, except in some cases where medical care and hearing aids are provided. A careful study of the extent of hearing defects among the aged should be made and possible methods of preventing such defects determined.

**The blind and partially blind.** According to the census reports, there are about the same number of totally blind people in this country as there are totally deaf—that is, about 60,000. While the causes of blindness and deafness are not usually necessarily the same, there are many similarities between them. Some are hereditary and others accidental. Of the two handicaps, blindness is more likely to elicit sympathy, and most persons would not hesitate to pronounce it the more serious defect.

However, if the one or the other is present at birth, it is probable that congenital total deafness is at least as great, if not greater, a handicap to educational and social adjustment than congenital total blindness. Of course, such a contention would be hard to prove, and the problem presents many serious practical and theoretical difficulties. Moreover, this contention is based upon the results of the few tests that have been made and upon general observation, rather than upon any well-substantiated comparisons of the two groups in the performance of common tasks.[18]

The totally blind must be trained by special methods. A blind child must necessarily receive special attention, for, unless special instruction is given, he is not likely to succeed in life's adventures. Dr. Cutsforth, himself blind from a very early age, has well analyzed the principal difficulties of the blind child. For example, he points out that ideas of space and size, which are such important factors in the life of the seeing child, are developed only with great difficulty in the blind. While the normal small child uses kinaesthetic and tactual cues as important aids in developing space notions, vision soon takes over these functions and becomes the one large conveyer of space knowledge. This transfer can, of course, not take place in the blind child. The blind child is almost certainly self-centered. He is restricted in his world, and therefore makes more of his limited world. His own body takes on unusual significance. Many perversions of personality may develop because of these unnatural experiences. Nevertheless, with proper care and training, there is no reason why the blind child may not develop into a normal personality.

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[18] For an excellent discussion of the problem, see Haines, T. H., "Mental Measurements of the Blind," *Psychological Monographs*, Vol. XXI (1918) and Hayes, S. P., *Ten Years of Psychological Research in Schools for the Blind*, Pennsylvania Institute for the Blind, 1927. For a summary of these studies, see Pintner, R., *Intelligence Testing*, New York, Holt, 1931; and Cutsforth, T. D., *The Blind in School and Society*, New York, Appleton-Century, 1933.

In several studies using tests especially constructed for the purpose, blind children have been found to average about ten I.Q. points lower than seeing children. There is also a large percentage of low-grade feeble-minded among the blind than among the seeing. This is no doubt due partly to the fact that many of the blind have received very poor instruction. Other cases depend upon a fundamental physical defect, which is associated both with blindness and the accompanying mental deficiency. After eliminating the relatively larger percentage of feeble-minded among them, Hayes[19] found the blind, grade by grade, little below seeing children in schoolwork. Although poorest in reading, they were good in language work.

## Speech Defects

Speech defects form another serious handicap to many children and adults. Several city surveys have shown that as high as twenty-five per cent of the child population is affected with speech handicaps, of which about one in fifty cases, or one half per cent, are serious. Probably the percentage for adults is not very different from that for children. Speech defects are of several different kinds, the most common being stuttering, or stammering, and lisping.

Many different theories[20] have been proposed for explaining speech defects. Some of the more common ones explain defects in terms of malformed palate, emotional disorders, cerebral dominance, correction of natural left-handedness, and Dunlap's theory that a person stutters on sounds connected with obscene words. This last theory is used to explain why stuttering is more common with boys than girls and with "proper" rather than "bad" boys.

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[19] Hayes, S. P., *Mental and Educational Surveys in Seven Schools for the Blind,* Report of the Twenty-fifth Convention of the American Association of Instructors for the Blind, Overlea, Maryland, 1920.

[20] Travis, Lee, *Speech Pathology,* New York, Appleton-Century, 1921.

In many large cities, special classes are provided for children with speech defects. Although several corrective methods are used, the percentage of success is not great. A method that may succeed with one child may have no effect whatever on another child. Many private clinics have been provided for the treatment of adults. All sorts of methods, from psychoanalysis to oral surgery, are used with varying success. Some of the best work in this field is being done in clinics connected with various universities, such as those at Iowa, Wisconsin, Minnesota, Northwestern, Columbia, and others; but of course these can reach only a small percentage of those who need training. Not until a large corps of trained teachers can be provided for private clinics and for special speech classes in schools, can a very adequate attack be made on defective speech.

## The Upper Limits of Society

We have thus far spoken only of those who are themselves handicapped or who are a handicap to society. The chapter would not be complete without at least some mention of the fact that our population includes also the elite, who make up the other end of the distribution. Except possibly for sensory defects, for which there probably are not an equal number with superacuity, people seem to be about equally distributed on either side of the mean.

To compensate for the large number of feeble-minded, there are a corresponding number of geniuses. These are the people who constitute our inventors and discoverers, our leaders in social and educational reform, and our political leaders. Most of our mental surveys have shown a well-balanced distribution of I.Q.'s, with as many above the normal as below. It is, of course, to this upper group that we must look for leadership. The rest contribute their part and are essential, but our hope for the future lies in the upper limits of the distribution.

**Gifted children.** Professor Terman, whose study has already been mentioned several times, made a very extensive comparison of bright children with normal children. He selected approximately 1,000 California children from the ages of two to nineteen with I.Q.'s above 130, and a similar number with I.Q.'s averaging 100. These two groups he compared in many ways, with the following results:

In physical condition and health, the gifted group was superior. At birth these children averaged three fourths of a pound heavier than average children, and they exceeded the control groups in size and weight at all ages. The gifted group walked a month earlier than average children and began to talk three months earlier. In general health, the gifted children were also above the average. Eighty-five per cent were accelerated one year or more in school, and not one of them was retarded. Although they were accelerated in school, their advantage was not equivalent to their intellectual level as measured by intelligence tests; neither were they advanced up to their level as measured by achievement tests. The subjects in which they excelled and were most interested were reading, arithmetic, and language; those which interested them least were penmanship, manual training, and sewing.

The least difference between the two groups was probably in play activities. The gifted group was less interested in active vigorous games and more interested in mildly social and quiet games. In reading outside the classroom, the gifted children clearly stood out. The average gifted child of seven years read more books in two months than the average of any control group up to fifteen years of age. Eight- and nine-year-olds among them read three times as many books as the control group of the same age. The books read by the gifted group covered a wider range and included more science, history, biography, travel, poetry, and drama, and relatively less adventure and mystery stories and emotional fiction. Figure 35 gives a comparison of the two groups for intellectual, social, and activity interests. Based upon a free-association test, the gifted group excelled the control group by 1.4 sigma in intellectual interests and by 1 sigma in social interests, while both groups were about equal in activity interests.

A similar comparison of the two groups on seven personality and character tests shows a consistent advantage for the gifted group. Contrary to popular opinion, bright children are decidedly better adjusted to life than normal children. They are not a weakly, nervous, ill-adjusted group but healthy, vigorous, and well adjusted, both socially and morally.

Seven years later, Terman[21] made a follow-up study of 587 of the initial group that he had studied. It was possible to administer only a part of the whole battery of tests to many of the subjects in this second study. Seventy-three were given the Stanford-Binet test. There was a slight decrease in I.Q., but little less than might be accounted for by a lack of sufficient number of tests and the method of determining the scores at the upper end of the scale.[22] In schoolwork these follow-up cases

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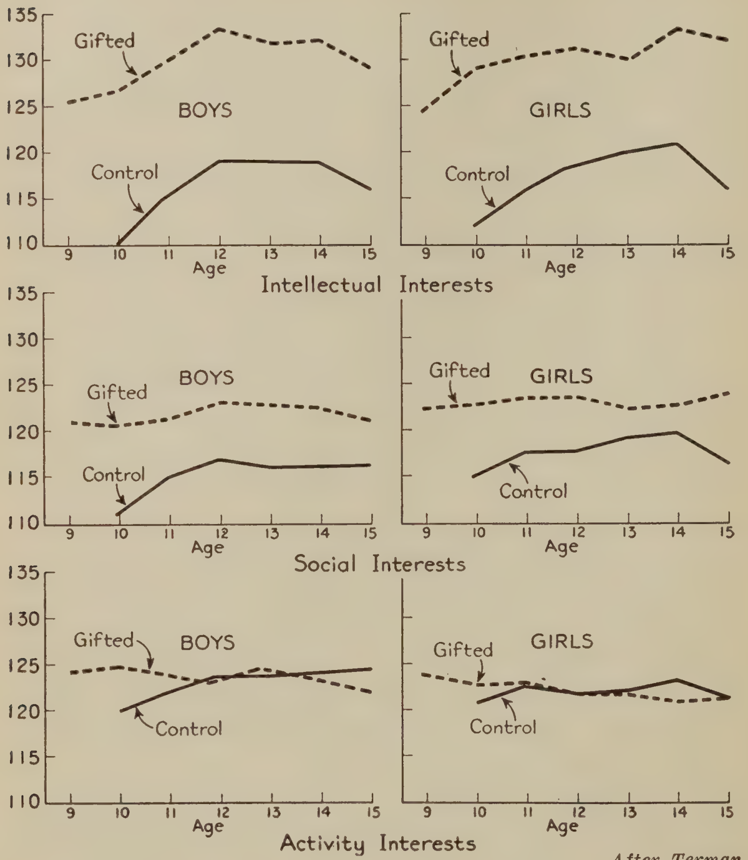
[21] Terman, L. M., *et al., Genetic Studies of Genius,* Vol. III, Palo Alto. California, Stanford University Press, 1936.



*After Terman*

Fig. 35.—Scores on Interest Tests for Gifted and Control Groups of Children.

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[22] The older Stanford-Binet scale, which was used in this study, was too difficult at the upper end, especially for superior adolescents and adults. This defect has been corrected in the 1937 revision of the scale.

were continuing to do successful work. Nearly three fourths of the group were either in or through college, or planned to go to college. Those who had graduated were in some cases already showing marked ability in their chosen fields. Their superiority was not limited to schoolwork but extended to personality traits and social adjustments as well. For the most part, these children differed from normal children only in that they were above average in most desirable traits.

Terman's results have been substantiated and extended by Mrs. Hollingworth[23] and others. Mrs. Hollingworth finds evidence that, as a rule, the child of superior intelligence is above normal in more ways than those found by Terman. She measured a group of fifty children (I.Q. 135–190) for strength and speed of voluntary movement, and found the gifted children superior to the normal group. The reason that bright children are often believed to be inferior in motor skills is because they are generally younger than their classmates, with whom they are compared. If compared with children of their own age, they would generally be found to be above average. In surveying the vocational choices of superior children, Mrs. Hollingworth shows that, as a rule, they make intelligent selections early in life. Among illustrations of such choices she lists the following as typical:

> Boy, I.Q. 143—Will study zoölogy, "because father is a zoölogist, and animals are so interesting." (Coy)
>
> Boy, I.Q. 162—Will take up the oil business, "because there is a lot of money in it, and because I like the work, and I have a lot of relatives in that business." (Coy)
>
> Girl, I.Q. 159—Will teach school. "I think I am better

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[23] Hollingworth, Lela S., *Gifted Children,* New York, Macmillan, 1926. Also Scheidemann, Norma V., *The Psychology of Exceptional Children,* Boston, Houghton Mifflin, 1931.

fitted for that work." Also music. "I like to hear the notes blend together in beautiful harmonies." (Coy)

Boy, I.Q. 187—"I want to work at whatever has the most mathematics in it, when I grow up." (Hollingworth)

Girl, I.Q. 189—"Will be a physician, and combine that with music, painting, and story writing." (Hollingworth)

Boy, I.Q. 156—Expects "to go to college, and take up scientific agriculture." (Terman)

Girl, I.Q. 133—Will be "a piano soloist." Expects "to graduate from university at 21 years, then marry and go on with piano work." (Whipple)

The superior child offers fewer problems in discipline than the average child. Occasionally a bright child who is not given tasks to challenge his ability may be a disturbing element in the schoolroom, but he is seldom seriously delinquent. Mrs. Hollingworth says that she has never seen a child of I.Q. above 130 under arrest, and has found no authentic mention of such a case in the literature of the subject. These results are in agreement with the work of May and Hartshorne,[24] who find a positive correlation between character and intelligence. But a word of warning about a too general acceptance of such a view should be given. This warning no doubt applies more to adults than to children. At least some great crimes have been committed by intelligent persons. While, as far as we know, Al Capone and Ivan Kreuger were never given an intelligence test, they would no doubt have rated high. Other men of superior ability could easily be named who, although they generally keep within the law, would, in any impartial rating, be classed as a menace to society. We have always had the crook, the swindler, and the traitor. Such men have often been men of intelligence and ability; otherwise they never would have succeeded as they did. Intelligence and character tests may correlate positively, but there are many individual exceptions, which makes any true correlation between intelligence and morality far from perfect.

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[24] May, M. A., and Hartshorne, H., *Studies in Deceit,* New York, Macmillan, 1928.

**Special abilities.** In addition to superior general intelligence, there are those who possess special talents, as in art, music, mathematics, and mechanical ability. Several studies[25] have been made of the early lives of great men. In a large number of cases, great artists have shown their ability early in life. For example,

Mozart had begun to invent musical ideas at the age of four, and at seven years he had published four sonatas for the piano and violin. Beethoven began regular musical instruction at six. At the age of fourteen, Van Dyck had produced a portrait of an old woman, which is still extant. Rubens was apprenticed in art at thirteen, and Michaelangelo was so proficient at that age that he received a salary. The latter studied with Lorenzo de Medici from fourteen to sixteen, and formed intimate associations with great artists at this early age. Most students of English literature have been reminded of the fact that Longfellow's first poem was published at the age of thirteen and that Bryant wrote his *Thanatopsis* at seventeen. Tennyson began serious writing at the age of twelve, Macaulay at eight, and Goethe wrote in German, Greek, and Latin at nine. These names have been selected at random from a much longer list of similarly eminent men who have showed marked ability at an early age.

Mrs. Hollingworth has studied the evidence of rapid mathematical calculators and finds that some such as Gauss, Ampers, and Hamilton were outstanding scholars of their day. Others have been men of mediocre ability.

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[25] Cox (Miles), Catherine M., *Genetic Studies of Genius*, Palo Alto, California, Stanford University Press, 1926.

The writer recently interviewed a man who claims to have surpassed some of the most wonderful feats of an internationally known rapid calculator. This man is not regularly employed and seeks demonstrations of his ability in order to charge a small fee. It is not to be inferred from this that great mathematicians such as Newton, Fechner, Poincaré, Einstein, and so forth are other than men of the highest mental ability. If there is any basis for Spearman's theory, of a *g* factor, there must be a large *g* factor in mathematics. Nevertheless, there are many great men who are not, and probably never could be, great mathematicians.

Another field in which we find men possessing unusual talent is motor skills. The great athlete often gains more popular attention than the great scholar. Most daily papers are printed in two sections—one devoted to world and local news, the other to sports and finance. Although the sports section comes second, this is by no means proof that it is read less. During the football and baseball seasons, it is common practice to place much sporting news on the first page, as well as in its accustomed place.

There has been a tendency in modern times, as in the days of Greek ascendancy, to belittle manual skill other than in athletics. At present, there is a swing back toward an interest in manual skills. This applies not only to the fine arts and crafts but to other motor skills as well. In the schools, handicrafts are no longer limited to classes in automobile mechanics for boys who have difficulty with their regular school subjects; instead they extend to all types of manipulation and construction, with a view to creating interests and ability in work for leisure time. Airplane design or construction may be as interesting and as valuable a leisure-time activity for a boy as reading good books.

**Individual differences in special abilities.** In this chapter, special emphasis has been placed on extreme types of ability rather than on the general distribution of special abilities. In keeping with this point of view, this section has dwelt with some typical special abilities, their manifestation in childhood, and some illustrations of their presence in adults.

There would be sufficient justification for a general discussion of the distribution of special abilities in a normal population. In other words: Are special abilities distributed as other traits? There is a definite answer to this question in the case of two of the abilities studied. Seashore [26] found normal distributions in each of his tests of musical ability for adults. Some of the distributions for children show a disproportionate number possessed of lower ability. This Seashore believes is due to a lack of information and training in observation rather than to an actual lack of ability. Paterson [27] and Stenquist [28] have constructed tests of mechanical ability and found a normal distribution in unselected groups.[29] It is generally assumed that other special abilities would show similar distributions if we had any means of measuring them.

**Social and moral leaders.** In the discussion of extreme types, so far only the lower end of the distribution for social and moral traits has been mentioned. There is without doubt a compensating type of social and moral leadership at the upper end of the distribution. This statement assumes, of course, that society is distributed normally on such traits. Until the Thurstone Attitude Scales[30] or some other measure of social attitudes or values have been given to large sections of the population, we can only assume this to be true. However this may be, we have had and continue to have great social, political, and religious leaders whose influence has raised the social and moral levels of society. We need only mention such leaders as St. Francis, St. Augustine, Martin Luther, Florence Nightingale, George Washington, Abraham Lincoln, and Frances Willard to illustrate this type of leadership.

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[26] Seashore, C. S., *The Psychology of Musical Talent,* Boston, Silver Burdett, 1919.

[27] Paterson, D. G., *et al., Minnesota Mechanical Aptitude Tests,* Minneapolis, University of Minnesota Press, 1930.

[28] Stenquist, J. L., *Measurements of Mechanical Ability,* New York, Columbia University, 1923.

[29] These tests are generally scored by translating the raw scores into percentile standing. Such a method artificially makes all distributions alike. However, a study of the raw scores also shows a close approximation to normal distributions. It is upon this basis that the above statement is justified.

## Summary

Types have been considered here as the extremes of a distribution of the population. When human behavior has been viewed as a matter of adjustment to life, it is called more or less intelligent behavior. A person who possesses unusual ability of this kind is spoken of as being exceptionally intelligent or a genius. A genius, from this point of view, is not qualitatively different from other people; he is only farther removed from the average than others. Then there is the other type of individual who is so unable to solve the problems of life that we call him feeble-minded. Likewise, men are differently adjusted to social and moral laws and customs. Some men are outstanding leaders in social, political, and moral reforms; others are social outcasts and criminals.

Psychology, as a science, is as much interested in the defective, the insane, and the criminal as it is in the genius, the well-adjusted person, and the social and political leader. On the other hand, if science is to be used to benefit society, then it must suggest methods by which the level of society can be raised. There are three principal ways in which this can be done:

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[30] Thurstone, L. L., and Chave, E. J., *The Measurement of Attitude,* Chicago, University of Chicago Press, 1928.

(1) By reducing the numbers at the lower end of the distribution. Any method that will reduce the number of defectives, insane, and criminals will improve the general level of society. In olden days, this was sometimes accomplished by killing off groups of such people. Natural selection and even wars tended to aid in this process. In modern times, these methods have not affected the lower groups much, if any, more than other groups. In fact, war has taken the best members of society, apparently leaving the lower groups to reproduce more rapidly than other groups. Despite this fact, there seems to be some force at work which counteracts these degenerative tendencies. No doubt universal education and superior training account for some improvement. There are probably also other social forces which society might use to counteract this tendency. Some that have already been used, or at least suggested, are sterilization, segregation, and birth control.

(2) By increasing the number of members in the upper levels of society. This condition is not easy to attain. Decreasing birth rates among the elite are all too common. Whether preferential tax rates or other governmental assistance to those with large families, irrespective of their economic standing, will materially help to correct this condition remains to be seen.

(3) By raising the general standards of society. The most likely method for accomplishing this result is through education. Japan has reduced her illiteracy to

less than one per cent within the last century through general education. Russia is reported to have reduced illiteracy from ninety to thirty per cent in less than a generation. Although there is probably as much general interest in education, especially among the higher levels, in the United States as in any other large country of the world, there is still a great deal of room for improvement. Chapter X will point out some of the advantages, as well as limitations, in our present educational system.

### Exercises

1. Comment on the proposition that, in any one trait, people form a continuum and that representatives of every level, from lowest to highest, may be found in that trait. How is this concept related to the idea that people fall into distinct types? Name traits in which you would expect to find representatives all the way from the lowest to the highest.

2. In what way do the following differ: (*a*) the feeble-minded from the genius; (*b*) the introvert from the extrovert; and (*c*) the suggestible from the negativistic?

3. What is normality, and who is the normal individual?

4. How low an intelligence level must a person have in order to be called feeble-minded? In which traits are the feeble-minded especially low? Name some occupations in which the feeble-minded are never able to engage and others in which they may enter with hope of some success.

5. Comment upon the frequency of insanity in our population. Has it been increasing or decreasing in recent years? What part do you believe such variables as methods of diagnosis and size of cities have had on these figures?

6. Indicate the nature of the distinction made by the classification of disorders as organic and functional.

7. Point out the confusion which may be involved in using the term "criminal" as both a legal and a psychological term. In which trait, or characteristic, is the criminal an extreme deviate? On what scale is he at the lower end?

8. On the average, what position do you think criminals occupy on scales representing the following variables: (*a*) intelligence; (*b*)

emotional stability; (*c*) health; (*d*) age; (*e*) education; and (*f*) industry?

9. What type of curve would be obtained by a survey of the hearing ability of a very large group of twelve-year-old children? Would those so low as to be called hard-of-hearing be relatively more or less numerous than those at the other end of the scale?

10. How is the fact of mental retardation of the deaf related to the question of the inheritance of intelligence? Does intelligence appear to be as much the product of inheritance as is height, for example?

11. Comment upon the relative mental ability of the deaf and the blind.

12. Suggest methods of classroom care of the hard-of-hearing child.

13. If we assume that the number of feeble-minded is just as large as the number of geniuses, what are we to assume concerning the number of persons of other levels of ability?

14. Comment upon the health and physical development of children of very superior mental ability.

15. What are some of the difficulties in play activities which eight-year-old children with I.Q.'s of 150 or more will encounter? How will these children compare in play interests with those of their own: (*a*) age; and (*b*) mental abilities?

16. In what school activities are children with very high I.Q.'s likely to be average or only a little above average? How is their standing in these activities to be explained?

17. Did Terman's subjects with very high I.Q.'s deviate as much from the average in grades as they did in I.Q.? If a group of 1,000 children were selected from a population of 100,000 on the basis of their high grades in schoolwork, would you expect their I.Q. ratings to be relatively as high? What generalization can be made concerning the relative deviation from the average in traits B, C, D, and E for a group which has been selected because of its great deviation above the average in trait A?

18. What is the prognosis for those who are extremely high or extremely low in mental ability during grammar school? What is likely to be their standing in: (*a*) adolescence; and (*b*) middle age?

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## CHAPTER X

# Individual Differences in Personality

### What Is Personality?

It is generally true that the more complex a function, the more variable it is. Personality is no exception to this rule. Personality is made up of many factors and, although it would be hard to prove, man no doubt varies more in personality traits than in any other of his characteristics.

Man has always more or less clearly realized differences in personality. He has always estimated and rated himself and his fellow man on the basis of his personal qualities. Without any clear notion of just what constituted these qualities or how he could measure them, he has been confronted with the practical problem of individual differences in personality as a basis of industrial, economic, political, religious, and other differences.

In current literary style, John Smith is described as "a fine-looking, ambitious, intelligent young man who is governed by the moral code of his rather fast social set." He is intent upon acquiring as much of this world's goods as he can, while still "playing safe." He is a leader in his club and has already been elected to a position of responsibility. Can we describe this hypothetical person in more exact scientific terms? Can we differentiate him from the many other Smiths and Jones of his and other communities? This is the problem set for this chapter and one which, at the present time, has admittedly only been answered in part.

We shall not attempt to define *personality* in any more exact way than to say that it refers to those individual qualities which distinguish one person from another. This differentiates it from *self,* which is the more inclusive term. *Self,* according to William James, includes such things as the material body and even one's possessions, as well as what he called the "spiritual" self. *Character* is sometimes used as the equivalent of personality. However, it is more often used synonomously with *moral conduct* and classed as one of the traits of personality.

The study of personality presents some interesting problems of both theoretical and practical importance. This study is a modern development. Psychology, beginning as it did with a study of the soul, has gone through the successive stages of emphasizing the problems of mind and later those of consciousness, and has now begun to be much interested in the problems of personality. This is especially true of clinical and social psychology and, at least in some degree, of general theoretical psychology.

The discussion of personality in this chapter will be divided into three main parts. The first part will treat of some of the factors which determine the nature of personality. These factors are both innate and environmental. It is trite to say that personality is modified by such influences as the home and the school. In what ways and to what extent personality is dependent upon or modified by these influences is more significant. The second part of the chapter will deal with attempts to separate personality into its various elements. Many similar endeavors at a logical analysis of personality have already been made. Kretschmer's analysis of personality into four types, each with its own physical and mental characteristics, is an example of this kind of analysis. The third part of the chapter will deal with attempts to measure some phase or phases of personality. The more recent studies of personality have generally tried, not to analyze personality into all of its elements, but rather to analyze and to measure some small but significant features thereof. Allport's Ascendance-Submission Test is an illustration of this type of measurement.

## How Personality Develops

*Personality,* as the term has been used in this chapter, is a complex of many different elements. Whether or not we call the social relations among the lower animals *personality,* we nevertheless find differences at this level. Different breeds of dogs possess marked differences. The airedale is a nonsocial "one-man" dog; the Irish setter, a social animal that seeks association with other dogs and with humans. Dogs, in turn, have different traits from cats or monkeys.

What is the basis of this differentiation? Is it dependent upon the fundamentally different physical make-up of the various animals or is it due primarily to their social heritage? The answer to this question, like so many others, is that both are contributing factors. Although a cat can be trained to do many things a dog will do, it still remains a cat. Its method of hunting is by stalking and it hunts alone. Most dogs track game. When there is more than one, they hunt in packs; and when game is seen, the dog makes a direct charge upon it. While it is taught many tricks in hunting and in behavior about the house, there is without doubt a large innate factor in a dog's social behavior.

In man, we find great differences, not only within a single race or cultural group, but also between groups. As was pointed out in a previous chapter, Margaret Mead and many others[1] have shown that there are great differences between primitive cultures, as well as between these cultures and our own. In studying personality, we are too prone to consider only our own society or culture and to neglect the fact that, in other parts of the world, there are cultures which are different and in many respects diametrically opposed to our own. For example, if we wish to see the counterpart of our society, which is based primarily upon competition, we should not necessarily go to Russia to see a truly coöperative society but to such tribes as the Arepesh of New Guinea or to the Samoan Islands. In these societies, coöperation is not a political measure but is developed as an integral part of the personality structure of the members of the group. The various Negro tribes of Africa, the different classes of India, as well as our own American Indian tribes, present many variations in culture. Someone has pointed out that the deviations of these people from the norm are different from our own. That is, their forms of insanity differ as much from our own as do the norms themselves.

Since it has already been stated that personality is a composite of physical and cultural factors, we may now consider the important features of each and how they affect the final product.

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[1] Mead, Margaret, *Sex and Temperament in Three Primitive Societies,* New York, Morrow, 1935; and *Co-operation and Competition Among Primitive Peoples,* New York, McGraw-Hill, 1937. Also Benedict, Ruth, *Patterns of Culture,* Boston, Houghton Mifflin, 1934; and Herskovits, M. J., "Culture Areas in Africa," *American Anthropologist,* Vol. XXVI, (1924), pp. 50–63.

**Physical basis of personality—The glands.** It must be admitted at the outset of this discussion of the physical basis of personality that the evidence for much that is here stated is not conclusive. Although there has been considerable study of this topic, the experimental proof that physical structure directly influences personality is not extensive. Nevertheless, there is sufficient reason for believing that some physical characteristics do influence personality directly and that others have many indirect effects on personality development.

One of the oldest theories concerning the physical basis of personality was founded upon the doctrine that the body contained substances called *humors*. These humors were supposed to control the temperaments, or more constant emotional tendencies. This early doctrine has a modern analogy in the theory of the importance of the endocrines or hormones. There are at least ten or twelve hormones that have been isolated and chemically analyzed. While they all have an effect upon bodily growth and function, not all of them have generally been assumed to have any primary effect upon personality. Only those that seem to have any important influences will be discussed here.

The thyroid gland, located in the neck region, supplies a substance called *thyroxin,* of which iodine is one essential element. This gland normally keeps a constant supply of this iodine-bearing hormone in the blood. When there is too little thyroxin, a person develops a condition of lethargy, fatiguability, and general inertia. If this deficiency of thyroxin is extreme in youth, the body becomes dwarfed, the skin dry and scaly, and the hair sparse and coarse. The mentality is also seriously impaired.

This condition is called *cretinism*. The effect of an oversupply of thyroxin, called *hypothyroidism*, produces nervousness, irritability, and high emotionality. It is not difficult to see how the thyroid gland may affect personality development. This is especially true if the gland is abnormally active or inactive. As indicated, if this condition is present early in life, the effect will be much more pronounced. A child with a highly active thyroid is likely to become a highly emotional individual; one with a sluggish thyroid is likely to become the opposite type of individual. Hinton[2] has shown that basal metabolism, which is directly related to thyroid secretion, is rather highly correlated ($r = .70 \pm .02$) with intelligence in children. For the younger ages, the correlation was considerably higher (.80 at age six and seven) than in later years (.53 at fifteen). If intelligence is so affected by basal metabolism, then it is reasonable to believe that other personality traits are also affected.

The pituitary gland produces two secretions. The anterior lobe of this gland manufactures a hormone which regulates body growth. An oversupply of the secretion of this gland produces *giganticism*. The tall men often seen in the circus are illustrations of this type of disorder. The tall boy of Alton, Illinois, who at nineteen was eight feet, six inches in height and weighed 435 pounds, is a good example. The pituitary may also be diseased, so that it will not produce a normal amount of secretion. This results in dwarfism. When the latter condition is not present at birth but occurs later in life, certain characteristic features develop. Ruch[3] tells of a California artist suffering from pituitary and thyroid disorders who feared that he would develop into a caveman. His chin and breastbone were being drawn together; his head grew until he wore a size 8½ hat. He decreased in height from five feet seven and one-quarter inches to five feet three inches within seven years. This case shows how glands may change the body form even of adults. How much greater effect or control then, may they have on normal growth in childhood. The posterior lobe of the pituitary secretes a hormone (possibly more than one) which regulates blood pressure, tonicity of the smooth muscles, and sex development. Overactivity of the posterior lobe of the pituitary, which may be brought about by the injec-

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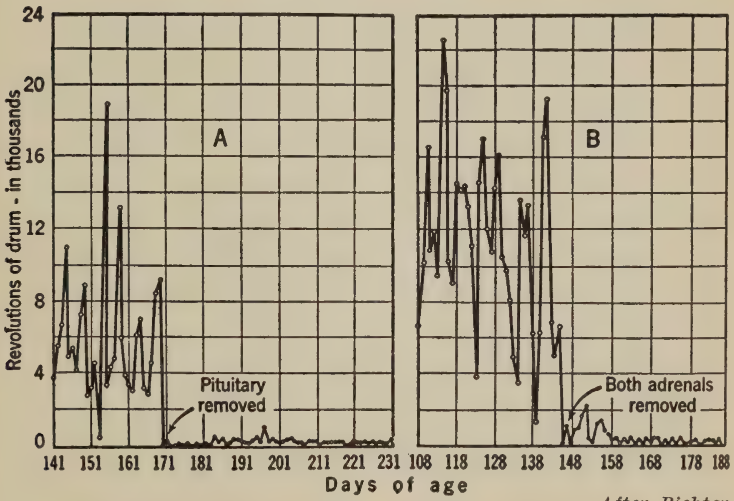
[2] Hinton, R. T., Jr., "Role of the Basal Metabolic Rate on the Intelligence of Children," *Summaries of Doctoral Dissertations of Northwestern University*, Vol. V (1937) pp. 215–219.

[3] Ruch, F. L., *Psychology and Life*, Chicago, Scott-Foresman, 1937.



*After Richter*

**Fig. 36.**—Endocrine Glands in Relation to Activity. (Graph A shows the effect produced on a rat's running activity by loss of the pituitary gland; Graph B, the effect produced by loss of the adrenal glands. Reproduced from Richter, C. P., *American Journal of Orthopsychiatry,* Vol. 2, 1932.)

tion of pituitrin, raises the blood pressure, heightens the tonus of smooth muscles, and produces abnormal sexual development. An underactive pituitary produces the opposite effect.

The adrenal gland is also composed of two parts. One part, the cortex, produces a secretion the amount of which seems to be correlated with general bodily activity. An oversupply produces heightened body activity and energy. A dearth of this secretion produces a condition of inertia. The other secretion of the adrenal gland is called *adrenin* or *adrenalin.* This secretion is released into the blood in a state of emotional excitement. The heart is stimulated to greater activity; blood sugar is released in the blood stream; tonicity is increased in the striped muscles, and decreased in the involuntary muscles. This puts the body "on a war basis." In fact, shell shock has been explained as a form of psychosis due to chronic overstimulation of the adrenal gland.

The gonads, or sex glands, in addition to their primary function of reproduction, also secrete a hormone. The interstitial cells of the male produce the male hormone and the corpus luteum of the female produces the female hormone. As pointed out in Chapter V, sex is determined by the chromosomes, but a hitherto unpublished work has shown that the growth of the reproductive organs is controlled by the sex hormones. By injecting the female hormone into male rat embryos, their sex-organ development was changed so that they developed female sex organs. There have been some cases where, through disease of the endocrines, the sex of adult chickens and goats has been reversed. Apparently there have also been a few authenticated reversals of sex in humans. It is claimed that at least one of the female athletes who competed in the last Olympic games has married and assumed the functions of the male in the family. As already stated, the sex hormones have a direct control of secondary sex characteristics. Just how much of the emotional and other personality differences between the sexes are directly controlled by endocrine secretions, we do not know. It may well be, for example, that the male hormone does definitely induce aggressiveness. The fact that eunichs are unaggressive and "feminine" is evidence in this direction. Some of the work of Terman and Miles on sexual perversions (see pages 162 ff.) lends some further support to this view.

Other endocrine glands have been mentioned as influencing personality. Among these are the parathyroids, the thymus, and the pancreas. But the effects of these glands are not as direct or evident as those that have just been described. Although the various glands have been treated separately in the above discussion, actually they work as a closed system. There is a definite interrelation of checks and balances among the different glands. The influence of one gland may be increased by some and retarded by others. Not enough is known about these facts, and most of what is known is too technical for presentation here.[4]

As has already been suggested, almost all degrees of belief are held concerning the effect of the endocrines on personality. Berman, in his famous book entitled *Glands Regulating Personality,* ascribes almost everything to these glands. His extreme view is well expressed in the following quotation:

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[4] For a more complete discussion of this subject in nontechnical language, see Dashiell, J. F., *Fundamentals of General Psychology,* Boston, Houghton Mifflin, 1937. For a more technical treatment, see Howell, W. H., *Textbook of Physiology,* thirteenth edition, Philadelphia, Saunders, 1936.

> A man's nature is chemically his endocrine nature. Primarily, when he is born, he represents a particular inherited combination of different glands of internal secretion. They, constituting the inventory of his vital stock in trade, start his life. Afterwards, food, the routine of his existence, the accidents of experience, education, disease, and misfortune, in short, environment, modify him because they modify his ductless glands and his vegetative apparatus as well as his brain, depressing some parts and stimulating others, and so rearranging the system. In particular will he be transformed as the gland is affected, which is the center of the system to which the others adapt and accommodate themselves. The inertia of the system is very great, almost absolute, and always tends to return. If he has children he hands on his constellation of endocrines, in spite of mishaps, not at all or only slightly transformed. Sometimes, however, the experiential transformation has been sufficiently deep and has shaken the very constitution of this germ plasm. So family dispositions and traits, national and racial temperaments, are propagated, maintained, and varied.

Very few modern endocrinologists or psychologists would go so far as this in explaining personality on the basis of glands. Indeed, there are those who go to the other extreme and believe that glands have little or nothing to do, at least directly, with personality. From the evidence at hand, it seems reasonable that certain glands, especially when one or more of them are out of balance and are either over- or under-secreting, have some direct influence on personality. This is particularly true if this influence is present early in life. There is no question, for example, but what the lack of thyroxin, as in the extreme case of cretinism, affects both the physical development and intelligence. While the experimental proof is not so clear, it has been the writer's own experience, living as he does in an area where people are unusually susceptible to hyperthyroidism, that many people have what may well be characterized as a thyroid disposition or high emotionality. These facts, together with the other evidence that has already been cited, seem sufficient reason for supporting the general idea that some glands may directly influence personality.

There is another subtle influence of the glands on personality besides those already discussed. If body growth is controlled by glands, their activity may well influence personality. This is much more true of course in cases of unusual size or body form. The nicknames "slim," "red," or "fatty" are only one indication of this fact. Physical deformities and other characteristics also are likely to affect personality. The lame child is not only physically handicapped in play but also socially handicapped; the unusually pretty child is much more likely to attract attention and thereby be spoiled than the average child; the homely girl has to make compensations in order to become socially efficient.

One of the few studies in which physical factors have been found to correlate with personality traits was conducted by Rich,[5] who made chemical analysis of the saliva and urine of groups of students who had received careful personality ratings. While all his correlations were low, several of them were above what would be expected by chance. The highest relationships were found between hydrogen-ion concentration—an indication of the alkalinity of the saliva—the amino acid content of the urine, and creatinine—a crystalline alkaline base which is produced by the process of metabolism. These he correlated with aggressiveness and excitability, as follows.

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[5] Rich, G. J., "Biochemical Approach to the Study of Personality," *Journal of Abnormal and Social Psychology,* Vol. XXIII (1928), pp. 158–175.

TABLE XXXVII

CORRELATIONS BETWEEN BODY ALKALINITY, ACIDITY, AND PERSONALITY RATINGS OF 39 UNDERGRADUATES AND 18 GRADUATES

| | *Undergraduates* | | *Graduates* | |
|---|---|---|---|---|
| | *Aggressiveness* | *Excitability* | *Aggressiveness* | *Excitability* |
| Salivary alkalinity... | .09±.11 | .28±.09 | .51±.11 | .45±.12 |
| Urine acidity....... | −.31±.1 | −.25±.1 | .00±.15 | −.26±.15 |
| Body weight........ | −.49±.08 | −.22±.1 | −.31±.14 | −.17±.15 |
| Creatinine content, body weight...... | .......... | −.24±.1 | .......... | −.23±.15 |

There is also some slight experimental evidence that unusual amounts af alkalinity or acidity may be connected with some kinds of psychoses. Alkalinity is associated with depression and acidity with excitability.

There are, of course, many notable examples of people who have overcome physical handicaps to become great leaders. Demosthenes, with his speech defect, Napoleon, with his small stature, Theodore Roosevelt, with his poor health as a child, and Helen Keller, deaf and blind from eighteen months of age, are illustrations. These and many thousands of other less well-known cases prove that nature's control over our personality is not invincible. It can be profoundly modified by the environment. Let us now trace some of the social factors which play such a large part in personality development.

**Social factors in personality.** Stagner[6] has given us one of the best accounts of the various influences which go into the development of a normal personality. Morgan[7] has also discussed many of these factors, as well as those which produce maladjustments both in childhood and adult life. Here we are more concerned with the normal growth of personality development. One of the most important factors in the development of personality is the home. This is true both because its influences come earliest in the life of the child and because, as a rule, more of the child's time is spent in the home than under any other single influence.

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[6] Stagner, Ross, *Psychology of Personality,* New York, McGraw-Hill 1937, Chs. XVII–XXIII.

The first social influence that affects the child is the feeding and care exercised by mother or nurse. The old idea that love of the child for a parent is explained in terms of an instinct has been changed to include the conditioning effects of these early experiences. Neither is it necessary to accept the Freudian doctrine that sex is the all important element in this conditioning process. The child *learns* to love the person who contributes to his happiness and well-being. In the normal home, this child-parent relationship will develop normally. It is not difficult to understand how this love which is ordinarily established between mother and child is extended to other members of the family. Thus, father and brother and sisters—if there be such in the home—partly by contributing to the needs of the child and partly by projection, become substitute stimuli for the love responses of the child.

In some cases the care and protection of the child are overemphasized. If the child receives too much care, its helplessness is prolonged and it remains a weak, submissive individual. There is sometimes an interesting deviation from this situation when the child revolts from his early protective influences. A child brought up under conditions that normally produce a dependent "sissy" may suddenly develop into an aggressive, domineering type of person. These instances of compensation make the prediction of personality from case histories particularly difficult.

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[7] Morgan, J.J.B., *The Psychology of the Unadjusted School Child,* revised edition, New York, Macmillan, 1936; and *Psychology of Abnormal People,* revised edition, New York, Longmans, Green, 1936.

The child is naturally egotistic. If he is placed on his own responsibility early in life, he will learn to fight for himself. This often occurs where there is conflict in the home, such as parental discord; where other children usurp the attentions of the parents; or where, for economic or other reasons, the child is thrown much upon his own. It is not a mere accident that the bully is so often the product of the streets and alleys; such a boy must learn to fight for himself. Nor is it an accident that so often such persons later become local bosses in politics and industry.

If the parents are highly emotional, the child is subjected to strong excitement and frequent conflicts. Whether or not the child is predisposed to emotionality, early conditioning is almost certain to make him more emotional. In contrast, a calm, unemotional home is conducive to a similar attitude in the child. A visit to the homes in almost any neighborhood where there are children will bring out great individual differences in emotionality.

Morgan shows how persistence may be developed. If the child wishes something which is not granted immediately, he may continue to try to obtain it. For example, the child may want a piece of candy and begin to cry for it. If he succeeds in getting the candy, he will be more likely to cry again the next time. If the time between his seeking and his ultimate success is increased, his persistence will be proportionately increased. This, of course, is only a practical illustration of the familiar delayed-response experiment so common with animals. The more intelligent the animal or child, the longer may be the delay between the stimulus and the delayed response. Persistence can be developed toward certain situations and not toward others. The child may find that persistence works with one parent and not with the other. Persistence may therefore be specific or it may, on the other hand, become a generalized trait. The child may learn ways and means of seeking his various wants and keep after them until he succeeds, in so far as success is possible with the means at his command. Persistence is a virtue as long as it is directed toward the ends which the parent or other person wishes. If the end which is sought is not that desired by the parent, then the trait is more likely to be called stubbornness. The principles involved are the same in either case.

Morality or immorality is largely a matter of habit. Habits in morals are as hard but no harder to form than habits in other fields. The only difference is that often there are strong emotional elements involved. The motives are often very intense and persistent. This is why the formation of good habits or the breaking of bad habits seems so different from the formation and breaking of other kinds of habits. Since the child wants certain things and wants them badly, his egoistic tendencies are sure to come in conflict with the rights and property of others. If the child sees a toy that attracts him, his impulse is to seize it. If he is thwarted, he may forget about it or, if the opportunity presents itself later, he may take it when no one is watching. From the point of view of society, this is stealing. If he is successful in such attempts, the child will learn that stealing is the easiest way to get what he wants. He will develop clever ways of stealing. Habits of lying are formed in a similar way. The child will learn to lie and steal if it pays; if lying and stealing bring pain instead of success, the child will learn the more socially acceptable ways for obtaining his wants and needs. Hence we see that the best moral principles in the home may not result in good moral training. The child of the strict parent may learn to evade his father and get what he wants by stealing and lying. In contrast with such control, the parent who trains his child in such a way that good conduct pays can do so without necessarily seeming to be strict or hard on the child.

Other personality traits and their development might be discussed. Any adequate discussion of the topic of personality development would include the effects of family discord and broken homes. Mrs. Mowrer[8] has shown what an important factor domestic discord can be in the development of the personality. Several studies have shown the prevalence of criminality in broken homes. The psychiatrist is continually finding that his patients come from homes where the parents were maladjusted or where their own married life was unhappy.

**Economic factors and personality.** Shaw,[9] in his studies of delinquency areas in Chicago, has shown the close relationship between delinquency and poverty. This fact is to be explained on the grounds that those without the ordinary necessities of life are likely to try to secure such necessities by any means. When we realize that half of our population comes from families where the income ranges only slightly over 100 dollars per month, we can appreciate how acute this problem is. Several recent studies[10] have shown the relation of economic factors to personality. Morals are not the only thing affected. The thwarted individual may break under the pressure and give up or he may revolt and become a dominant, aggressive individual. It is no accident that most radicalism is found in the lower economic brackets and most conservatism among the rich. One study has shown the profound effects of a depression on the morale of those thrown out of work.[11] What could not be shown so well was the effect of the lack of good food and clothing and the loss of morale and emotional discord on the personalities of the children in the homes of men and women thrown out of work.

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[8] Mowrer, Harriet E., *Personality Adjustment and Domestic Discord,* New York, American Book Company, 1935.

[9] Shaw, Clifford, *Delinquency Areas in Chicago,* Chicago, University of Chicago Press, 1929.

**Personality maladjustments.** Several times mention has been made of the fact that the child is egoistic. He has many needs and wants, and he makes many adjustments in order to secure these ends. As long as his adjustments are made according to the usual social standards, they are considered normal adjustments. Some children learn much more efficiently than others how to attain their goals, but regardless of whether their adjustments are relatively successful or unsuccessful, as long as they follow accepted methods, we call them "good" adjustments.

There are other kinds of responses, however, by which a person may seek to reach a goal. These other types are called *maladjustments.* Schaffer[12] lists five types of maladjustments: (1) adjustment by defense; (2) adjustment by withdrawal; (3) adjustment by fear and repression; (4) adjustment by ailments; and (5) persistent nonadjusting reactions.

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[10] Stagner, *op. cit.*

[11] Rundquist, E. A., and Sletto, R. F., "Personality in the Depression," *Institute of Child Welfare Monograph,* No. 12 (1936), University of Minnesota Press.

[12] Schaffer, L. F., *Psychology of Adjustment,* Boston, Houghton Mifflin, 1936.

(1) *Adjustments by defense.* A child may not be succeeding in school. Instead of giving up, he may try something else. Johnnie may not be able to do his arithmetic problems, but on the playground and in the street he may get the better of the other boys in his class. He therefore proceeds to lord it over his fellows and becomes a bully. One common form of defense is rationalization. The boy who is having trouble in his college studies may decide that a college education is not worth while. He tells himself and others that the man who is successful is the one who has gone into business as a boy and worked his way up from the bottom.

(2) *Adjustments by withdrawing.* In many respects this is the opposite of the first type. The child who is failing in school becomes silent and seclusive. Where no effort is made, there can be no failure. If this tendency to withdraw persists, it may result in psychopathic tendencies. This is the general background of dementia praecox and schizophrenia. If the withdrawal is passive, it takes the form of hebephrenia, and the person lives in a world of phantasy.

(3) *Adjustment by fear and repression.* When confronted by any serious task or the possibility of some danger, we are likely to develop fears. An infant fears only a few things, such as loud sounds and lack of physical support. Early man feared wild beasts, other men, lack of food, and violent changes in nature, such as storms, fires, and floods; he also feared the spirits of these dangerous objects. Any list of the fears of modern man is legion. The writer recently asked a class in general psychology to list their principal fears. The list made

most interesting reading and showed that supposedly protected college students are not immune to fear. Fear is a normal reaction for everyone. Fear may even be irrational, as when we fear thunder and lightning and yet realize that not more than one tenth of one per cent of the population is killed or seriously injured by lightning. It is when fears are intense and persistent that fear becomes abnormal. Only by a visit to an institution for the insane can we realize what mortal fears may possess a man.

(4) *Adjustment by ailments.* This form of withdrawal might be considered as a special form of withdrawal. The child who does not want to go to Sunday School finds that his throat is sore on Sunday morning. When such tendencies become pronounced, the condition results in hysteria. Such excuses are common to all of us. We are continually making excuses to ourselves and to others that we cannot do this or that. Only when feigned sickness becomes a habitual retreat does it become pathological.

(5) *Persistent nonadjusting reactions.* When a person develops some form of maladjustment, such as withdrawal or ailment, this form of adjustment becomes his pattern of response whenever difficulties arise. If, however, no set form of maladjustment is developed, this does not mean that behavior is well adjusted. A person may react by nervousness, anxiety, and physical exhaustion. The name neurasthenia has sometimes been applied to the more extreme form of such reactions.

It is not to be inferred that these five classes of maladjustments listed by Schaffer are all-inclusive, clear-cut, or mutually exclusive. There are forms of maladjustment that cannot be readily classified under any of these headings, and there are also overlappings and similarities between the different forms. Nor is it to be inferred that they all represent pathological states. Everyone uses these different types of adjustment mechanisms; it is only when they become extreme and habitual or recur frequently that they are considered abnormal.

This very brief account of some of the most important social factors which control or modify our personality development has been greatly oversimplified. Some of the more elementary influences which affect the child have been mentioned. As these and other less common or well-known influences come to bear on the young child, his personality is molded from its simplest biological beginning. As he grows up, these influences become even more numerous and complex. Starting with different physical structures and susceptibilities, these environmental influences make us what we are. From the fact that the influences and their order and strengths vary from one individual to another, we have the explanation of human differences. These differences are not simple but very complex. They cannot be arranged, as some have attempted, on any simple linear scale. Any personality has many vectors, or directions, and each of these has different values. We all have our own personality and, as mentioned in the beginning of this chapter, we probably vary more one from another in personality than in any other way. One of the great tasks for the psychologist is to analyze personality and measure its different elements or traits. Much attention has been given to both of these problems. In a later section of the chapter, some of the better-known methods of measuring personality will be discussed and illustrated.

## Personality Types

**The humoral theory of personality types.** The first known analysis of personality types was made by the Greek philosopher Hippocrates. It was he who first conceived of the four types of temperament as based upon four bodily humors. Aristotle was impressed by this classification and accepted it with certain modifications. These humoral doctrines received general acceptance during the Middle Ages and have come down to the present with very few additions or modifications. As evidence of this fact, the reader is referred to many modern texts in psychology, where references are frequently made to the humoral doctrine of temperament.

Since the humoral theory is so well known, only the briefest reference will be made to it here. This doctrine assumes that there are four humors in the body, namely, the blood, phlegm, black bile, and yellow bile. These four humors form the basis of the four types of temperament, depending upon the respective dominance of one or the other of the humors. The corresponding temperaments are the sanguine, phlegmatic, melancholic, and choleric. This belief assumes that man's personality can be classified under one or another of these headings. These four temperaments, together with their possible combinations, form the elements from which all personality is formed.

This view, of course, does not explain the specific ways in which a humor expresses itself. For example, just how a person with a sanguine temperament will act cannot be exactly predicted. Nevertheless it does indicate his general attitude toward life and the difference, for example, between that and the phlegmatic attitude.

**Kretschmer's personality types.** Reference has already been made to Kretschmer's[13] classification of personality types. This classification is based upon physical differences. It also has some relation to classifications of the insane, since at least three of Kretschmer's physical types are related to types of insanity. In fact, he justified his classification by correlating these physical types with the predominance of these same types in the different wards of hospitals for the insane. Table XXXVIII, taken from Kretschmer, gives the basis for his contention:

TABLE XXXVIII

Relation Between Physical Types and Forms of Insanity

| *Physical Types* | *Number of Cases of Corresponding Psychopathic Types* | |
|---|---|---|
| | *Manic-Depressives* | *Schizophrenics* |
| Asthenic ............ | 4 | 81 |
| Athletic ............. | 3 | 31 |
| Asthenic-athletic mixed | 2 | 11 |
| Pyknic .............. | 58 | 2 |
| Pyknic mixed.......... | 14 | 3 |
| Dysplastic ........... | 0 | 34 |
| Deformed ........... | 4 | 13 |
| Total .......... | 85 | 175 |

The four main physical types listed by Kretschmer are well described, as follows:[14]

> The *asthenic* individual (also called *leptosome*), said to be of the schizophrenic temperament, is one who is of average height but is relatively tall for his weight. He is thin, with a long, narrow, shallow chest. His shoulders are relatively broad contrasted with the diameter of his chest. His muscles are thin and poorly developed, his skeletal structure is

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[13] Kretschmer, E., Physique and Character, New York, Harcourt Brace, 1925.

[14] Mohr, H. J., and Grundlach, R. H., "The Relation Between Physique and Performance," *Journal of Experimental Psychology*, Vol. X (1927), pp. 117–157.

> slight. The skin is thin and loosely attached to the underlying tissues. The face is characteristically long and narrow, with a prominent nose and clear-cut features. The facial angle is sharp, and the mid-face is relatively long.
>
> The *athletic* physique is similar to the asthenic in general bodily proportions but all of the structures are thicker, firmer and of more robust development. The shoulders are heavy, the chest is broad and of medium depth. The skeleton is heavily built. The muscles are thick, of good tone and are contoured. The skin is thick and closely adherent. The face is relatively long and narrow with proportions similar to the asthenic but with thick though well-defined features. The facial angle is less marked than in the asthenic and the lower jaw more heavily developed. The athletic build is considered a variant of the asthenic.
>
> The *pyknic* habitus type is described as one in which there is an increase in the volume of all of the body cavities. The head is large, the chest is voluminous and exceptionally broad and deep. Although the shoulders are of moderate width they appear narrow contrasted with the broad chest. The abdomen is full. The skeletal structure is slight when compared with the general bulk of the individual and the extremeties are relatively small and slender. The hands are small and delicate. There is a generous adiposity and the skin is thick and firm. The face is round and the midface is short. The complexion is ruddy.
>
> The *dysplastic* type includes many deviants from the normal. In this group are those physical forms evidencing disturbance of the various ductless glands. The elongated form of the eunichoid, hypoplastic forms and those in which there have been localized developmental disturbances, are included.

Table XXXIX gives the physical measurements for three of Kretschmer's physical types. Differences are not large but fairly consistent for the different types. Although he developed it as a result of studies of the insane, the author does not limit his classification of personality types to this field. Normal individuals are supposed to possess personality types of a similar kind, though less pronounced.

TABLE XXXIX

Principal Average Measurements of Kretschmer's Three Physical Types

| *Physical Measurements* | *Pyknic Type* | | *Athletic Type* | | *Asthenic Type* | |
|---|---|---|---|---|---|---|
| | *Men* | *Women* | *Men* | *Women* | *Men* | *Women* |
| Height (in centimeters).... | 167.8 | 156.5 | 170.0 | 163.1 | 168.4 | 153.8 |
| Weight (in kilograms)..... | 68.0 | 56.3 | 62.9 | 61.7 | 50.5 | 32.8 |
| Shoulder width (in centimeters)................ | 36.9 | 34.3 | 39.1 | 37.4 | 35.5 | 44.4 |
| Chest (mean of inspiration and expiration in centimeters)................ | 94.5 | 86.0 | 91.7 | 86.0 | 84.1 | 77.7 |
| Stomach (circumference in centimeters)........... | 88.8 | 78.8 | 79.6 | 95.8 | 74.1 | 67.7 |
| Hip (circumference in centimeters)................ | 92.0 | 94.2 | ..... | ..... | 84.7 | 82.2 |
| Forearm (circumference in centimeters).......... | 25.5 | 22.4 | 31.5 | 24.2 | 23.5 | 20.4 |
| Hand (circumference in centimeters)........... | 20.7 | 18.6 | 21.7 | 20.0 | 19.7 | 18.0 |
| Calf (circumference in centimeters)................ | 33.2 | 31.2 | 33.1 | 31.7 | 30.0 | 27.7 |
| Leg (length in centimeters). | 87.4 | 80.5 | 90.9 | 85.0 | 89.4 | 79.2 |

Kretschmer's theory has received much careful study. It sets forth a method of analyzing personality on a physical basis which, on first thought, appears easy to verify or disprove. His own work, while giving quantitative measures, is not presented in a form easy to interpret or to repeat. As Paterson[15] points out, Kretschmer has presented many measures but does not clearly indicate which he uses for diagnosis. Paterson says: "Altogether we are baffled in the attempt to get hold of clean-cut and unambiguous criteria upon which we may securely depend. . . . Quantitative measurements are given in terms of averages only unaccompanied by measures of variability." Kretschmer's classification of insane patients is very broad. For example, among his list of manic-depressive patients, he includes "involutional mania, senile and arterio-sclerotic depression, non-lunatic hypomania and habitually depressive temperaments.[16] Such methods are only too commonly found among those not trained in the rigorous statistical methods of objective science.

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[15] Paterson, D. G., *Physique and Intellect,* New York, Appleton-Century, 1930.

Several other workers[17] have found considerable verification of Kretschmer's point of view, especially with insane patients. Burchard,[18] for example, in a study of 407 male patients in various hospitals in this country, found the following percentages of cases:

TABLE XL

A COMPARISON OF MORPHOLOGICAL TYPES AND KINDS OF INSANITY

| *Morphological Types* | *Percentages of Insane Patients* | |
|---|---|---|
| | *Manic-Depressives* | *Schizophrenics* |
| Pyknic | 63.2 | 36.3 |
| Athletic | 8.8 | 17.7 |
| Leptosome (asthenic) | 28.0 | 46.0 |

Nearly twice as many pyknics were manic as schizoid, and about the same percentage of asthenics were schizoid rather than manic.

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[16] See Wertheimer, F. D., and Hesketh, F. E., "The Significance of the Physical Constitution in Mental Disease," *Medicine,* Vol. V (1926), pp. 375–463.

[17] For a good summary of studies of body types and personality studies, see Cabot, P. S. de Q., "The Relationship between Characteristics of Personality and Physique in Adolescents," *Genetic Psychology Monographs,* Vol. XX (1938), pp. 3–120.

[18] Burchard, E. M. L., "Physique and Psychosis," *Comparative Psychology Monographs,* Vol. XIII (1936), pp. 1–73.

In Russia, a study of a group of 100 male children between the ages of eight and eighteen showed that twenty-nine could be classified as pyknic, twenty-eight as asthenic, and the rest belonged to mixed groups. The pyknics were found to change more often from joyful to depressed moods and to have more emotional flare-ups, for which they were sorry later; they were affable, altruistic, and good-humored. The asthenics were characterized by lack of humor, the fact that they had but a small circle of friends, general repressed emotions of joy and sorrow, and a tendency to live in a world of phantasy.

Two other studies[19] have shown a relationship between body build and intelligence scores or scholarship. In one study of eighty-nine inmates of Illinois prisons, a correlation of .34 was found between Army Alpha scores and a tall and slender build, as contrasted with a short and heavy build. Another study with college students showed that the pyknic type had lower average grades and that more of them dropped out of college.

For the most part, these studies seem to indicate that there is some, though a very small, relationship between body build and certain mental characteristics. This relationship is even closer with types of abnormality than with normal subjects. However, some investigators have pointed out another factor that may at least help to explain this relationship, namely, that body shape is partly a matter of age. There is a tendency for people to become heavier as they grow older; in so doing, they tend to change from the asthenic to the pyknic type.

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[19] Mohr, G. H., and Grundlach, R. H., *loc. cit.;* and Pillsbury, W. B., "Body Form and Success in Studies," *Journal of Social Psychology,* Vol. VII (1936), pp. 129–139.

Furthermore, schizophrenia is an insanity of youth, while manic-depressive insanity tends to occur later in life.

Several studies comparing height-weight ratios and intelligence have shown very little correlation when age was kept constant. One study obtained a correlation of .04 for 1,000 students. In a more recent study[20] 153 male and 175 female college students were classified as pyknics and asthenics. The two groups were paired for age, socio-economic status, and educational background. When it came to physical build, the two groups were almost completely separated; but when compared on such tasks as cancellation, incidental memory, digit memory, mental ability, and scholarship, there was practically no difference between them. These results indicate that some of the relationship which has been found between physical types and certain mental capacities is at least partly a function of age.

It is not unreasonable to expect to find a relationship between certain physical measurements and mental capacities. Whatever influences effect body build might easily be expected also to affect mental growth. However, the reason for not being convinced by such an argument is the fact that thus far, when all extraneous factors have been carefully controlled, very low relationships have been found between physical and mental traits.

**Jung's personality types.** Despite all the problems they attacked, only one of the psychoanalysts, Jung, specialized in the problems of personality. While the majority of the studies of the psychoanalysts have dealt with more or less abnormal people, Jung was interested primarily in normal people. Basing his ideas partly on some writings of William James, Jung divided people into two classes. These he called *extroverts* and *introverts*. *Extroversion* he defines[21] as "an outward-turning of the libido (psychic energy)." He goes on to say:

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[20] Klineberg, O., Asch, S. E., and Block, H., "An Experimental Study of Constitutional Types," *Genetic Psychology Monographs,* Vol. XVI (1934), pp. 140–221.

> With this concept I denote a manifest relatedness of subject to object in the sense of a positive movement of subjective interest toward the object. Everyone in the state of extroversion thinks, feels, and acts in relation to the object, and, moreover, in a direct and clearly observable fashion so that no doubt can exist about his positive dependence upon the object. In a sense, therefore, extroversion is an outgoing transference of interest from the subject to the object. If it is an intellectual extroversion, the subject thinks himself into the object; if a feeling extroversion, then the subject feels himself into the object. The state of extroversion means a strong, if not exclusive, determination by the object. One should speak of an *active* extroversion when deliberately willed, and of a *passive* extroversion when the object compels it, i.e., attracts the interest of the subject of its own accord, even against the latter's intention. Should the state of extroversion become habitual, the *extroverted type* . . . appears.

*Introversion* Jung defines[22] as "a turning inward of the libido whereby a *negative* relation of subject to object is expressed." He develops this concept further, as follows:

> Interest does not move towards the object, but recedes towards the subject. Everyone whose attitude is introverted thinks, feels, and acts in a way that clearly demonstrates that the subject is the chief factor of the motivation, while the object at most receives only a secondary value. Introversion may possess either a more intellectual or more emo-

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[21] Jung, C. G., *Psychological Types*, New York, Harcourt, Brace, 1933, p. 542.

[22] *Ibid.*, p. 567.

> tional character, just as it can be characterized either by intuition or sensation. Introversion is *active* when the subject wills a certain seclusion in face of the object; it is *passive* when the subject is unable to restore again to the object the libido which is streaming back from it. When introversion is habitual, one speaks of an *introverted type.*

One criticism that has been leveled against this classification is that it represents a one-dimensional trait only. It seems unlikely that so complex a thing as personality can be described by a one-dimensional classification. Although there has been a great amount of study of introversion and extroversion, and no less than a dozen tests have been constructed to measure these types, yet we know very little about the subject. The acceptance or denial of the Jung classification of personality still remains on a theoretical rather than an experimental basis.

**Spränger's personality types.** An interesting deviation from the ordinary type of personality analysis is provided by Professor Eduard Spränger[23] of the University of Berlin. Instead of making a direct analysis of personality, Spränger studies the various ways in which men place values on things and events. He has made a study of the various attitudes which a man may have toward the world.

According to Spränger, we have many biological classifications but we need a mental or cultural classification. Classifications that have been proposed, such as those based on ideas, feelings, instinct, adaptation, and the like, try to resolve mental phenomena too simply. Following the Gestalt notion of the totality of the mental life, Spränger claims that the latter cannot be broken up into these simple elements. He then attempts to study what he calls the "structure of the human soul." While an analysis of the soul is not concerned with purpose and values, a structural or functional (these terms do not refer to schools of psychology but rather to methods in psychology) study is concerned with them. Thus Spränger justifies his method and his problems of studying human values. He finds six major values or attitudes in life. These are: (1) the theoretic attitude; (2) the economic attitude; (3) the aesthetic attitude; (4) the social attitude; (5) the political attitude; and (6) the religious attitude.

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[23] Spränger, Eduard, *Types of Men,* Halle, Max Niemeyer, 1928. Translated by Paul J. W. Pigors.

(1) *The theoretic attitude.* The dominant interest of the theoretical man is the quest of truth. Such a man is primarily interested in knowing. Aristotle praised this point of view when he said: "Knowledge is power." The theorist scorns the practical aspects of life; he is interested in principles rather than applications. Although primarily the attitude of the scholar, the theoretic attitude is by no means limited to him. Anyone whose aim in life is order is theoretically-minded. This order may be the empirical order of the scientist or the logical order of the philosopher. While the theoretic attitude is most closely related to the aesthetic attitude, certain differences will be pointed out between them. Spränger says that the theorist is an individualist. "He cares neither for his ancestors nor his neighbors, nor is he interested in public meetings. . . . The only kind of community which is in accordance with his nature is that of convictions held in common."

(2) *The economic attitude.* The man with the economic attitude in life is interested in utility. In general, utilities are goods in the form of physical products and forces. However, mental work may also be bought and

sold. The economically-minded person is always interested in how anything can be used. A fine painting is worth so much money; value, to him, is always expressed in terms of purchase or sale. This trait is supposed to be typically American and is brought out in novels like *Babbitt* and *Main Street,* by Sinclair Lewis. To the economically-minded, money, then, is power. All things are weighed in terms of buying power. Education is worth while only in so far as it is practical. To him, the purpose of government is to facilitate commercial intercourse within the state and between it and other states.

(3) *The aesthetic attitude.* Form and beauty are the essence of the aesthetic attitude. This attitude may express itself either in creative endeavor or in the appreciation of beauty. The aesthetic attitude differs primarily from the theoretical in that the former is always individual and subjective, while the latter is general and objective. The aesthetic man is often social, but he is not interested in helping others. According to Spränger, "every pronounced aesthetic is markedly erotic" and "the interlacing of this eroticism with sexuality is undeniable." This smacks of the Freudian doctrine of art as a form of sublimation of the sexual urge (the libido). There is considerable harmony between the aesthetic and the religious attitudes. The aesthetic creed is a religion of beauty; God, to him, is the highest ordering and form-giving power.

(4) *The social attitude.* Wherever the impulse to give oneself to another appears as the dominant drive, a special type originates, which Spränger calls the *social* type. It is founded upon love. This love may be individual—as the love of a mate—or it may be collective—as the love of a group. The motive force back of it is obtained from social relations, which become an end in

themselves. We must exclude all cases where the purpose is to control others, for this is the basis for the next type.

(5) *The political attitude.* For the pure political type, power is the supreme motive in life. The politically-minded man is interested in other men as something to be controlled. The basis of this control is not for economic gain but solely for the pleasure of domination. It is essentially a Nietschean doctrine. But power may be exercised in other ways than in politics; indeed, power, domination, and control may be exercised in almost any field. The leader is almost always ruled by a high sense of power and may be said to be dominated by the political attitude.

(6) *The religious attitude.* The essence of this attitude is unity. The religious man attempts to understand life and explain it in terms of a god as the creator of all. All value is derived in relation to His purpose and man's relation to it. For Spränger, religion is essentially mystical. This may take the form of pantheism, in which everything is divine, or it may take the form of asceticism, in which there is a general withdrawal from life. This was the doctrine of the monks of the Middle Ages who sought righteousness by withdrawal and meditation.

Aside from these main types, there are also all degrees of mixed types. In fact, pure types are only the result of an idealization of real life. Seldom, if ever, would anyone, for example, have a purely theoretical or religious attitude toward life.

The Spränger classification of types has been presented in considerable detail both because it is a new and interesting attempt at a classification of types and because it has been made the basis of an ingenious scale for the measurement of values.

**A classification of personality traits.** This chapter would be unduly extended if an effort were made to list all the various attempts at listing the traits of personality. Almost every text in general and social psychology contains such a listing. These range all the way from very simple classifications to very complicated systems of analysis. One outstanding example of a large list of personality traits is that presented by Yerkes and La Rue.[24] A more conservative, as well as more useful, list is given by Allport in his *Social Psychology*.[25] Allport analyzes personality into five traits, with from three to seven subdivisions for each. The five major traits are: intelligence, motility, temperament, self-expression, and sociality. Many other writers would add other traits. One that might well be added is morality.

This rather extended study of the various attempts to analyze personality can be justified here on the ground that the real purpose of such classifications is to differentiate between persons. Whatever system best distinguishes one individual from another is the one to be chosen. Unfortunately, no one system is perfect; and although all the modern ones contain certain elements of value, they seem to be lacking in certain important details. We can only hopefully look forward to a day when letters of recommendation and other personal descriptions can follow some system of organization and report in fairly objective terms the elements of personality.

## The Measurement of Personality Traits

**Approach to and problems involved in measuring personality.** Some idea of the extent of study and interest in the measurement of personality may be gained from the fact that a bibliography[26] on personality and character, published in 1927, contained 3,341 references. Certainly, if the list were revised, this number would almost be doubled at the present time. Even a brief attempt at summarizing some of the more important of these studies, such as that contained in Symonds *Diagnosing Personality and Conduct,*[27] would make a large volume.

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[24] Yerkes, R. M., and La Rue, D. W., *Outline of a Study of the Self*, Cambridge, Massachusetts, Harvard University Press, 1914.

[25] Allport, F. H., *Social Psychology*, Boston, Houghton Mifflin, 1924.

In any summary of these studies, there are several ways in which the problem might be approached. We might make a systematic classification of the studies and present appropriate examples for each of the personality traits. One great difficulty with this method is that the studies do not readily lend themselves to such a systematic treatment. For example, there are dozens of studies of introversion and extroversion but few adequate studies of morality and sociality. Therefore it seems best to classify the studies on the basis of the method used in measuring a particular trait and to list representative samples of how people differ in the various traits, as they are measured by these methods.

Before beginning this classification, some of the difficulties involved in such measurements of differences should be mentioned. These are somewhat similar to those encountered in any attempt at measuring mental traits, such as intelligence and scholastic aptitude. One of these difficulties is that of securing an adequate sample of the trait; indeed, this problem is probably more difficult in measuring personality than in any other field of measurement. Often the person being measured does not wish to betray all his characteristics. While not refusing to take a personality test, he may conceal some significant facts. This would be especially true if we were trying to measure morality. Even when there is a desire for full coöperation on the part of the person tested, it is often impossible for him to describe himself adequately. The person being tested is confronted with the problem of how to answer such questions as: "Am I a good mixer?" or "Do I often worry?" A person may not know the correct answer to such questions. Another problem is the difficulty of establishing how many and what kind of questions are necessary to constitute an adequate sampling. A person may give a correct answer to a number of questions on honesty, but how many such questions are necessary to establish a measure of the general quality called *honesty*? In fact, there are those who consider this latter difficulty an insurmountable obstacle in personality measurement. They question the existence of anything more than a series of specific tendencies. Then there is the problem arising from the possibility that a person may respond to an honesty situation in one way upon one occasion and in another way at another time. However, difficult as these problems are, most investigators believe there are certain definite *tendencies* toward honesty which, while hard to measure, may eventually submit to measurement.

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[26] Robach, A. A., *Bibliography of Character and Personality,* Boston, Sci-Art Company, 1927.

[27] Symonds, P. M., *Diagnosing Personality and Conduct,* New York, Appleton-Century, 1931.

**Steps in the construction of personality tests.** It seems probable that personality can be measured, though, as yet, not many tests outside the field of intelligence have proved of much practical value. One reason for this is that too often "get-rich-quick" methods have been used. An author has had a good idea and has constructed a test to measure some trait. He then gives the test to a beginning class in psychology, obtaining norms and possibly some other data about the test. But good tests require more factual evidence than this. There are several problems that must be kept in mind in constructing a good test. (1) The trait to be tested must be clearly analyzed and described. For example, if aggressiveness is to be tested, we must know what is meant by that term. (2) Items must be collected for testing the trait. We must discover the ways in which the trait is manifested and then construct situations that will illustrate this form of behavior. If we are testing aggressiveness, we must discover how aggressiveness is expressed and then construct test items which will show whether the subject is or is not generally aggressive. (3) Methods of scoring these items must be devised. At first thought, this may seem to be a small detail in test construction, but actually it is an important one. Good items in a test are good only in so far as they are quantified by some successful scoring device. Some of the various ways in which this is done will be illustrated in the tests to be described later in this chapter. (4) A test should have a high reliability—that is, it should give essentially the same score each time it is used for any person or group of persons. (5) A test should also be valid. It should measure what it purports to measure.

It seems relatively simple to measure the reliability of a test. This can be done either by correlating one form of the test with another form, by correlating one half of the test with the other half, or by retesting the same people. By the use of either of the first two methods, there is no reason for not securing a high reliability, except for the fact that it may take considerable patience to find enough items to produce a high reliability. There is yet another difficulty. The writer has, upon several occasions, secured a rather high reliability on a test with one group of subjects, only to find a much lower reliability upon repeating the test with another group. The reliabilities secured by an author of a test are also almost invariably higher than those found later by other workers using the same test. This may not be easy to explain but there is so much evidence for it that there is little question about its being a fact, nevertheless is true. By the use of the retest method, if there is but a short time interval between the first test and the retest, we can never be certain how much of the correlation is due to a remembrance of how the test was answered the first time. Retests given after some months generally give a much lower reliability. This may be due to the elimination of the memory factor or to a change in the personality of the subjects. It is very likely due in part to both factors. Table XLI gives the reliability coefficients for Pressey X-O tests of affectivity and idiosyncrasy traits when the second test was given at intervals of two, forty-five, and ninety days after the first:[28]

TABLE XLI

RELIABILITY COEFFICIENTS FOR PRESSEY X–O TESTS

*Affectivity Scores*

| *Number tested* | *Interval between tests* | *Test 1* | *Test 2* | *Test 3* | *Test 4* |
|---|---|---|---|---|---|
| 64 | 2 days........ | .85 | .86 | .82 | .87 |
| 46 | 45 days........ | .58 | .74 | .80 | .75 |
| 70 | 90 days........ | .70 | .67 | .65 | .51 |

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[28] McGeoch, J. A., and Whitley, P. C., "The Reliability of the Pressey X-O Test for Investigating the Emotions," Pedagogical Seminar, Vol. XXXIV (1927), pp. 255–270.

*Idiosyncrasy Scores*

| *Number tested* | *Interval between tests* | *Test 1* | *Test 2* | *Test 3* | *Test 4* |
|---|---|---|---|---|---|
| 64 | 2 days........ | .70 | .55 | .77 | .43 |
| 48 | 45 days........ | .53 | .28 | .46 | .52 |
| 70 | 90 days........ | .46 | .46 | .45 | .53 |

From the above data, we see at least one reason for different correlations of reliability for different investigators. The longer the time between the test and the retest, the lower the reliability.

Validity presents an even more serious problem. Whether a test measures what it purports to measure is, after all, the crucial point of any test. The difficulty of determining this fact has already been mentioned. Whether any test measures honesty, for example, depends first upon the establishment of what honesty is. If and when that is accomplished, it remains only to find some test items which correlate well with the criterion. We may state the problem more concretely, as follows: If we have groups of individuals varying from one extreme of honesty to the other, the next relatively simple problem is to find a test which gives a similar distribution for these same people.

Without some criteria of honesty, or any other trait for that matter, many investigators have resorted to the very questionable methods of rating as a basis of determining validity. There are two statistical reasons for seriously questioning this technique. First, taken under ordinary conditions, most ratings have a low reliability. Until the reliability of the criterion is high, successful validation is impossible. Second, it is seriously questioned whether ratings give a true measure of any trait. At least, the method is little better than relying on general opinion, and the only time when such opinion is worth anything at all is when it is rendered by experts. There are, no doubt, some cases in which the test is a truer measure of the trait than are the ratings with which test scores are statistically compared. When investigators find some more satisfactory method for making ratings reliable or devise some better method than they now have for validating tests, it will herald a great advance in the measurement of personality.

**Types of personality tests.** The various kinds of measures for personality may be classified into three groups, namely: (1) rating methods; (2) questionnaires, or pencil-and-paper tests; and (3) performance tests. We shall proceed to describe a few examples of each type:

(1) *Rating methods.* The first extensive use of ratings was initiated by Walter Dill Scott, as a basis of promotion of army officers during the World War.[29] Officers below

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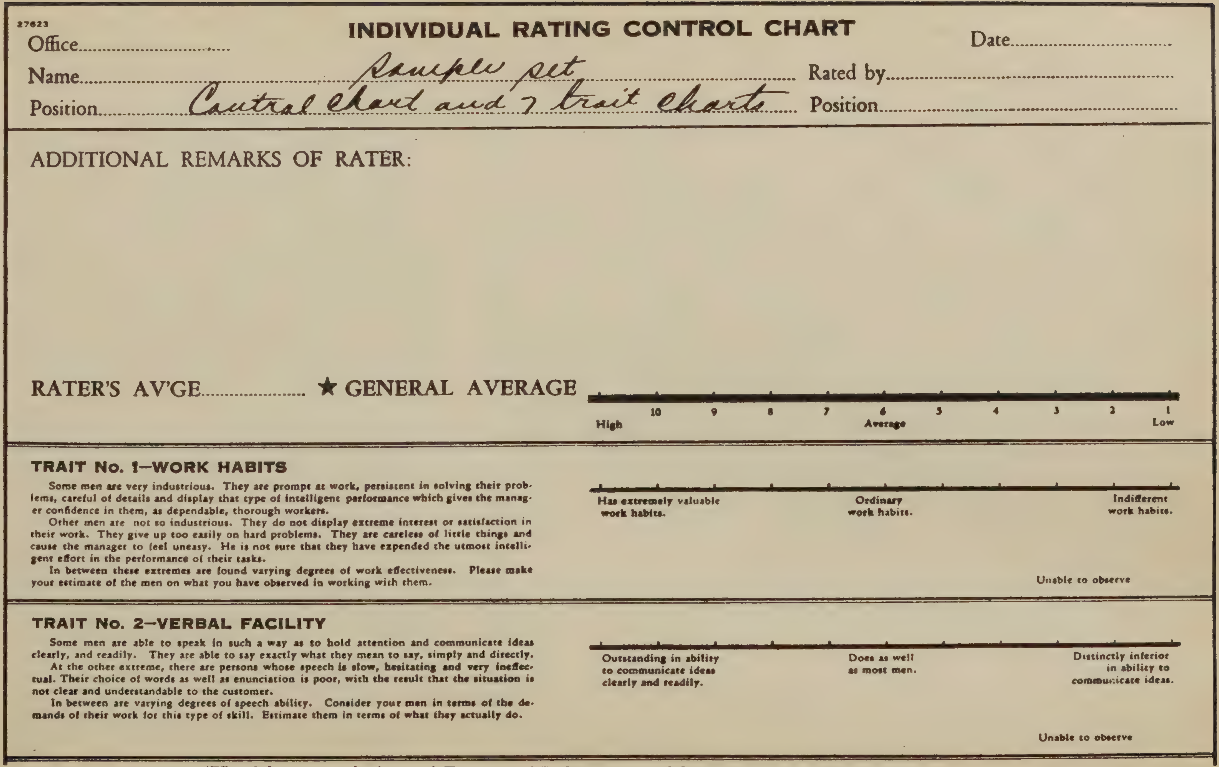
[29] The rating method devised by Scott (Scott, W. D. and Clothier, R. C., *Personnel Management,* New York, McGraw-Hill, 1932, Ch. XIII) is called the *man-to-man scale* because of the method used in establishing the scale values. Each rater constructs a master scale for each trait by selecting some acquaintances who possess the trait to the highest, high, middle, low, and lowest degrees, respectively. That is, if John Smith is constructing a master scale for rating intelligence, he will first select someone whom he knows who possesses intelligence of the highest degree and then someone who is least intelligent for the other end of his scale. He will also select three others for the intermediate positions on the scale. These five names he uses for comparison in rating any officer on intelligence. Thus, once constructed, this master scale can be used forever after. Other master scales may be constructed for the other traits.

Values were assigned to each step on the scale, the lowest being 3 and the next 6, 9, 12, and 15, respectively, except in the "general-value-to-the-service scale," where values ranged from 8 to 40. Thus any



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## INDIVIDUAL RATING CONTROL CHART

Office.................... Date....................

Name.......Sample set....... Rated by....................

Position.......Central Chart and 7 trait Charts....... Position....................

ADDITIONAL REMARKS OF RATER:

RATER'S AV'GE.................... ★ GENERAL AVERAGE

High 10 9 8 7 6 Average 5 4 3 2 1 Low

### TRAIT No. 1—WORK HABITS

Some men are very industrious. They are prompt at work, persistent in solving their problems, careful of details and display that type of intelligent performance which gives the manager confidence in them, as dependable, thorough workers.

Other men are not so industrious. They do not display extreme interest or satisfaction in their work. They give up too easily on hard problems. They are careless of little things and cause the manager to feel uneasy. He is not sure that they have expended the utmost intelligent effort in the performance of their tasks.

In between these extremes are found varying degrees of work effectiveness. Please make your estimate of the men on what you have observed in working with them.

Has extremely valuable work habits. — Ordinary work habits. — Indifferent work habits.

Unable to observe

### TRAIT No. 2—VERBAL FACILITY

Some men are able to speak in such a way as to hold attention and communicate ideas clearly, and readily. They are able to say exactly what they mean to say, simply and directly.

At the other extreme, there are persons whose speech is slow, hesitating and very ineffectual. Their choice of words as well as enunciation is poor, with the result that the situation is not clear and understandable to the customer.

In between are varying degrees of speech ability. Consider your men in terms of the demands of their work for this type of skill. Estimate them in terms of what they actually do.

Outstanding in ability to communicate ideas clearly and readily. — Does as well as most men. — Distinctly inferior in ability to communicate ideas.

Unable to observe

(Used by permission of Dean S. N. Stevens, of Northwestern University)

## TRAIT No. 3—ORIGINALITY

Some men are independent and creative in their thinking. They have "ideas of their own" which aid them in meeting difficult situations. They analyze their accounts and interpret their experiences in ways of action. They handle many problems without being shown all the details.

Others are not original in this fashion. They lack ability to deal with unusual conditions. They depend entirely on the manager's ideas. They have to be given guidance in every detail. They may be relatively rapid learners but never have ideas of their own.

In between these extremes are found varying degrees of originality. Consider the men you are estimating in terms of their tendencies as you have observed them. (Base your estimate on what they do.)

| | | |
|---|---|---|
| Unusually original. | Original as most outside men. | Shows no inclination to do original thinking. |

Unable to observe

## TRAIT No. 4—SOCIAL ADAPTABILITY

Some men arouse the greatest confidence in their associates and customers. They possess tact yet are firm. They overcome objections and get results without antagonizing people. They adapt themselves intelligently to different types of social and business situations, maintaining the highest standards of conduct.

Other men arouse uneasiness and distrust. They do not get along with people. They have a tendency to antagonize customers by their manner or attitude. They may get results at times but at the expense of goodwill and further cooperation.

In between are many degrees of success or failure at social adjustment. Consider your men as you know them yourself, as you have observed them in their work.

| | | |
|---|---|---|
| Very effective in getting along with customers. | As effective as the average. | Ineffective in influencing people. |

Unable to observe

## TRAIT No. 5—ABILITY TO DEVELOP

Some men have great natural ability to learn quickly, profit from past experience. They display a real capacity to develop in this business.

Other men seem very limited. They work hard but never do better than ordinary work. They learn slowly. There seems to be little evidence that they have the ability to become increasingly effective.

In between these extremes are many degrees of ability to develop continuously in this work. Consider your men. Are they on the way up? Or have some of them already given evidence that they have reached a level of achievement which is related to their basic capacities. Estimate the ability of your men to grow in this business.

| | | |
|---|---|---|
| Possesses very great promise. | Average abilities. | Little ability to develop further. |

Unable to observe

## TRAIT No. 6—GENERAL ABILITY AND VALUE TO COMPANY

Some men are of considerable value to the organization as a whole. They contribute many worthwhile ideas, as well as a great amount of time and effort. The quality as well as the amount of work they do is excellent. They despatch their work in a prompt orderly fashion and set records of achievement that are hard to equal.

Others have a poor working knowledge of the business as a whole and its relation to other things. They need constant prodding and follow-up in order to produce for the company. They never become a smooth running part of the organization.

The men you are judging fall somewhere between these extremes. Consider these men in terms of what they have already contributed to the company.

| | | |
|---|---|---|
| Extremely valuable to the company. | Average value. | Not an outstanding asset to the company. |

Unable to observe

## TRAIT No. 7—LEADERSHIP

Some men have unusual ability to inspire and command respect, obedience, cooperation, and loyalty of those under them. They are foremost in accepting the ideas and policies of the company and in leading others to use these methods.

Other men have to force and drive their men to get results. The men under this type of manager very rarely do work on their own initiative. The manager does not inspire men to do well, and they do not develop enthusiasm for their work from contacts with him.

In between these two limits are varying degrees of leadership. Consider the men you are estimating in regard to conditions as you have observed them in the office.

| | | |
|---|---|---|
| Extremely fine leader of men. | Ordinary leadership ability. | Shows little promise as a leader. |

Unable to observe

the rank of brigadier general were rated by their immediate superiors once every three months on five traits: physical qualities, intelligence, leadership, personal qualities, and general value to the service. Valuable as the Army rating scale was during the World War, it has not been used extensively outside the Army or in times of peace.

The most commonly used scale in industry is the *graphic rating scale.* The qualities on this scale are to be checked along a line. One end of the line represents one extreme of the trait and the other end the other extreme. Descriptive words may or may not be given along the line. Such scales have been used to rate personality traits and occasionally educational and vocational qualifications.

Rugg[30] has pointed out some of the values as well as the limitations of ratings. He believes they have little value unless three or more raters turn in independent ratings for any group. The raters must be well acquainted with the persons rated and the techniques of rating. One or two values of ratings should, however, be mentioned here. One is the value to the person making the scale and another is to the person doing the ratings. This work often calls attention to factors of importance and indicates a new and more valuable way of studying the subjects being rated. Symonds,[31] after an extensive study of rating scales, believes that, under

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officer might receive a quantitative rating anywhere between 20 and 100. Promotions and demotions were largely made on the basis of these ratings.

This method was used with considerable success in rating Army officers during the World War.

[30] Rugg, H. O., "Is the Rating of Human Character Practicable?" *Journal of Educational Psychology,* Vol. XII (1921), pp. 425–501; and 485–501; Vol. XIII (1922), pp. 30–42 and 81–93.

[31] Symonds, *op. cit.*

favorable conditions, the average reliability is about .55. This is not a very high coefficient. However, when we realize that, as a rule, only the better scales have been used for studying reliability and that many low reliabilities have not been published, it seems likely that even this average is too high. If this is true, the results from most ratings must not be taken too seriously.

(2) *Questionnaires, or pencil-and-paper tests.* The modern paraphrase of a sentence from the last chapter of *Ecclesiastes* would be: "Of the making of many questionnaires there will be no end." Questionnaires are made for all sorts of purposes and by all kinds of people. Each year the government sends out a questionnaire about our income; every few weeks a college official or some graduate student sends out a questionnaire in order to secure some information. Certainly G. Stanley Hall, who first popularized the questionnaire method, often receives anything but praise from those who have to answer extensive questionnaires.

As has already been indicated, the questionnaire method has many uses, but the only ones in which we are interested here are those used in studying personality. Symonds classifies personality questionnaires, or pencil-and-paper tests, as we shall call them, under three headings: adjustment tests, attitude tests, and interest tests.

Examples of the first type of test are the *Bernreuter Personality Inventory,* and the *Humm-Wadsworth Scale,* of the second type, the *Thurstone Attitude Scales,* and of the third type, the *Strong Interest Blank.* In discussing these tests, we might describe the methods of test construction and scoring, and uses of the tests. However, such a discussion would have little connection with the problems of individual differences, except as a description of methods for measuring differences. We shall therefore spend relatively little time in discussing the tests as such but continually keep emphasizing the results of using the tests. It is these results which bring out most clearly the differences between people.

The *Bernreuter Personality Inventory* consists of 125 items which have been collected from various sources. It may be scored in six different ways giving as many measures of personality. Scoring methods have been devised according to the author in such a way as to make the different results correlate highly (.90 or over) with: the Thurstone Neurotic Inventory; the Bernreuter Self-Sufficiency Test; the Colgate Mental Hygiene Test C-2, as a measure of introversion and extroversion; and the Allport Ascendance-Submission Test. A fifth and sixth scoring technique have been devised by means of factor analysis for the purpose of measuring self-confidence and sociability.

### Sample Questions from the Bernreuter Personality Inventory

1. Yes No ? Does it make you uncomfortable to be "different" or unconventional?
2. Yes No ? Do you day-dream frequently?
3. Yes No ? Do you usually work things out for yourself rather than get someone to show you?
4. Yes No ? Have you ever crossed the street to avoid meeting some person?
5. Yes No ? Can you stand criticism without feeling hurt?
6. Yes No ? Do you ever give money to beggars?
7. Yes No ? Do you prefer to associate with people who are younger than yourself?
8. Yes No ? Do you often feel just miserable?

Such a multifold way of scoring a test has its disadvantages as well as its advantages. First, this method is almost certain to produce a low reliability coefficient for the different parts of the test. It is unlikely that any relatively short battery of test items can prove to be a panacea for measuring personality, in view of the fact that so much difficulty has been encountered in measuring each of the traits which Bernreuter attempts to measure.[32] Second, a high correlation (.93) has been found between the neurotic tendency scoring and the introversion-extroversion scoring. A high negative correlation (–.82) has also been found between the neurotic tendency scoring and the ascendance-submission scoring. This means that these four scorings really measure but two personality traits. Table XLII gives the scores obtained from testing a typical college class of 159 students for introversion-extroversion by this method.

The Ogive curves below give decile norms for four separate scales of the Bernreuter Personality Inventory Tests. Different norms are given for high-school males and females and for college males and females. Norms for adults are also presented in the manual. The high-school norms are based upon about 300 tests and the college norms on about 750 tests. Bernreuter gives reliability coefficients for the six scales ranging from .78 to .92. Others using the scale have obtained much lower reliability coefficients.

It should, no doubt, be noted that little can be inferred from such scores as those presented in Table XLII and Figure 37 about the extent of personality differences. The reasons why such results cannot give us this information has already been made clear (See Chapter III). There are, however, some facts that can be gathered from such data. If these results are representative

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[32] See Gilliland, A. R., "What do Introversion-Extroversion Tests Measure?" *Journal of Abnormal and Social Psychology,* Vol. XXVIII (1934), pp. 407–412.

## TABLE XLII

Distribution of 159 College Students Scored for Introversion-Extroversion by the Bernreuter Personality Inventory

| *Personality Scores* | *Men* | *Women* |
|---|---|---|
| 130 to 139 | 0 | 1 |
| 120 to 129 | 0 | 0 |
| 110 to 119 | 0 | 0 |
| 100 to 109 | 0 | 1 |
| 90 to 99 | 0 | 2 |
| 80 to 89 | 2 | 1 |
| 70 to 79 | 1 | 2 |
| 60 to 69 | 2 | 2 |
| 50 to 59 | 0 | 6 |
| 40 to 49 | 3 | 3 |
| 30 to 39 | 4 | 6 |
| 20 to 29 | 4 | 6 |
| 10 to 19 | 2 | 11 |
| 0 to 9 | 1 | 4 |
| –10 to –1 | 5 | 9 |
| –20 to –11 | 3 | 6 |
| –30 to –21 | 10 | 6 |
| –40 to –31 | 5 | 10 |
| –50 to –41 | 7 | 5 |
| –60 to –51 | 3 | 3 |
| –70 to –61 | 5 | 5 |
| –80 to –71 | 2 | 2 |
| –90 to –81 | 4 | 0 |
| –100 to –91 | 1 | 1 |
| –110 to –101 | 2 | 0 |
| –120 to –111 | 0 | 1 |
| | 66 | 93 |
| Total | 159 | |

it seems that there are little if any significant differences between men and women in such traits, as those measured by the test. This holds true both for the average scores and for the deviations. Furthermore, the scores indicate that these traits are very normally distributed both above and below the averages. If we can assume that these scores are representative, and there seems every reason for believing that they are, at last not far from being representative, they give us a means of comparing the scores for others with those standards.

The Bernreuter scale has been used very widely for different kinds of personality studies. Terman and Buttenwieser[33] used it in a study of marital incompatibility, testing 100 each of happily married, unhappily married, and divorced couples. They determined which items in the scale were checked alike by both members of a happily married couple and which items could be checked differently without indicating marital discord. Hof-

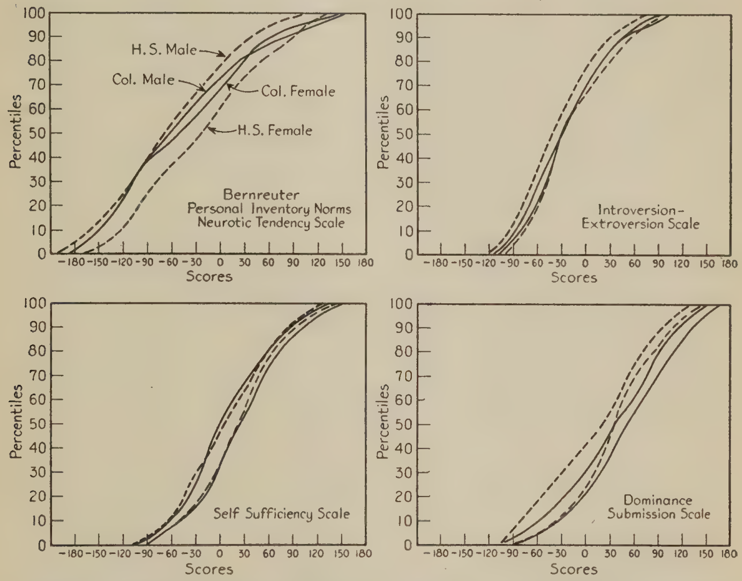

Fig. 37.—Ogive Curves Showing Decile Norms for Four Separate Scales of the Bernreuter Personality Tests.

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[33] Terman, L. M., and Buttenwieser, P., "Personality Factors in Marital Incompatibility," *Journal of Social Psychology*, Vol. VI (1935), pp. 143–171 and 267–289.

feditz[34] correlated scores between parents and children on three parts of the scale. The correlation between each parent and each child ranged from .01 to .27; the average scores for both parents, together with the average for all their children, ranged from .21 to .29. These correlations are lower than might be expected. The test has also been used to predict such things as character defects and salesmanship ability, but with only limited success. By intercorrelating +, —, and ? answers on the Bernreuter scale separately, Lorge[35] found very low reliabilities. He argues that the reliabilities claimed for the test are inherent in the scoring keys rather than in the test itself. This is a serious criticism and, if justifiable, the test has but a very limited usefulness.

The *Allport*[36] *Ascendance-Submission Test* consists of a series of questions with from two to four possible answers for checking, bearing on subjects where dominance or submission are likely to be shown. There are two forms of the test, one for men and the other for women.

SAMPLE QUESTION FROM THE ALLPORT ASCENDANCE-SUBMISSION TEST

At a reception or tea, do you seek to meet the important person present?

usually .............(+1)
occasionally .........( 0)
never ...............(—2)

Differential scores are given for each answer to each question. A person's score is the algebraic total of the answer values for each question that is checked. Table XLIII gives decile norms on the test:

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[34] Hoffeditz, E. Louise, "Family Resemblances in Personality Traits," *Journal of Social Psychology,* Vol. V (1934), pp. 214–227.

[35] Lorge, I., Bernholz, E., and Sells, B., "Personality Traits by Fiat," *Journal of Educational Psychology,* Vol. XXVI (1935), pp. 273–278 and 427–434.

[36] Allport, G. W., and F. W., *The A-S Reaction Study: Manual of Directions,* Boston, Houghton Mifflin, 1928.

TABLE XLIII

DECILE NORMS FOR 847 MEN AND WOMEN TESTED BY THE ALLPORT A-S REACTION TEST

| *Decile Norms* | *Degree of Ascendance or Submission* | *Men* | *Women* |
|---|---|---|---|
| 1 | A4 | +81 to +24 | +112 to +47 |
| 2 | A3 | +23 to +16 | + 46 to +35 |
| 3 | A2 | +15 to +10 | + 34 to +28 |
| 4 | A1 | + 9 to + 6 | + 27 to +19 |
| 5 | Average | + 5 to + 1 | + 18 to +16 |
| 6 | Average | 0 to — 4 | + 15 to +11 |
| 7 | S1 | — 5 to —10 | + 10 to + 7 |
| 8 | S2 | —11 to —17 | + 6 to 0 |
| 9 | S3 | —18 to —24 | — 1 to —13 |
| 10 | S4 | —25 to —79 | — 14 to —91 |

The reliability of the test for men was found to be .58 (corrected by the Spearman-Brown formula to .74) and .78 for women. Its validity, as measured in terms of ratings, was from .29 to .32. As has been pointed out, this low correlation may be due, at least in part, to the unreliability of the ratings.

The *Thurstone Neurotic Inventory* [37] differs from most tests of this type in that it attempts to determine, not so much the specific type of personality maladjustment, as the amount of neurotic tendency in the individual. It was constructed by collecting questions from many sources, such as the Woodworth Personality Schedule, Laird's Mental Hygiene Test, Freyd's list of introversion-extroversion items, and Allport's Ascendance-Submission Test. A total of over 600 questions were assembled. When duplications and overlappings were eliminated, 223 questions remained. This battery of questions was given to 694 University of Chicago freshmen, in order to determine the amount of neurotic tendency present among them.

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[37] Thurstone, L. L., and Thurstone, T. G., "A Neurotic Inventory," *Journal of Social Psychology*, Vol. I (1930), pp. 1–30.

The tests were first scored on the basis of the author's opinion of the "most likely" neurotic answers. These answers were then checked by the "criterion of internal consistency," by which the authors refer to the relative frequency of checking any neurotic answer by those making high or low scores. That is, each item was checked as to its correct scoring according to the relative frequency that it had been checked *yes* and *no* by those who showed an either distinctly high or low neurotic tendency on the whole test. The authors believe this to be a better method of validating the test than by personal opinion or by rating scales. While this may be true, yet the method is somewhat suggestive of lifting oneself by one's own bootstraps.[38] Table XLIV gives the frequency distribution for the 694 subjects used in the study, with scores given in terms of the number of neurotic answers that were checked. The data are classified by sex. A separate classification is given for fraternity members and for Jews, as distinguished from other "racial" groups.

The following table shows certain sex differences between college students. While the difference between the mean score of 37.3 for men and 43.8 for women is statistically significant, it is nevertheless small. It may represent a real difference in neurotic tendency between the sexes in the university or it may only represent a greater tendency on the part of the women to check neurotic

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[38] For an excellent criticism of the various methods of validating questionnaires, including the method of internal consistency, see, Mosier, C. I., "On the Validity of Neurotic Questionnaires," *Journal of Social Psychology,* Vol. IX, 1938, pp. 3–17.

## TABLE XLIV

Frequency Distributions for 694 College Students Tested by the Thurstone Neurotic Inventory

| *Personality Scores* | *Freshmen* | | | *Freshman Fraternity Members* | | | *Freshman Jews* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Men* | *Women* | *Total* | *Men* | *Women* | *Total* | *Men* | *Women* | *Total* |
| 0 | 8 | 3 | 11 | 3 | ... | 3 | 1 | ... | 1 |
| 5 | 18 | 7 | 25 | 3 | ... | 3 | 6 | 1 | 7 |
| 10 | 20 | 13 | 33 | 3 | 2 | 5 | 4 | 1 | 5 |
| 15 | 40 | 14 | 54 | 13 | 3 | 16 | 7 | 5 | 12 |
| 20 | 43 | 26 | 69 | 14 | 4 | 18 | 7 | 3 | 10 |
| 25 | 40 | 31 | 71 | 8 | 5 | 13 | 6 | 6 | 12 |
| 30 | 51 | 31 | 82 | 16 | 4 | 20 | 10 | 3 | 13 |
| 35 | 26 | 22 | 48 | 4 | 1 | 5 | 7 | 4 | 11 |
| 40 | 22 | 26 | 48 | 4 | 3 | 7 | 4 | 4 | 8 |
| 45 | 21 | 27 | 48 | 3 | 7 | 10 | 6 | 5 | 11 |
| 50 | 22 | 23 | 45 | 2 | 4 | 6 | 5 | 7 | 12 |
| 55 | 22 | 19 | 41 | 4 | 3 | 7 | 2 | ... | 2 |
| 60 | 11 | 15 | 26 | 1 | 2 | 3 | 4 | 2 | 6 |
| 65 | 7 | 9 | 16 | 2 | 1 | 3 | 1 | 1 | 2 |
| 70 | 8 | 9 | 17 | 1 | ... | 1 | 2 | 1 | 3 |
| 75 | 6 | 11 | 17 | 2 | 1 | 3 | ... | 2 | 2 |
| 80 | 8 | 4 | 12 | ... | 1 | 1 | 3 | ... | 3 |
| 85 | 3 | 2 | 5 | 1 | ... | 1 | 1 | 1 | 2 |
| 90 | 3 | 6 | 9 | ... | ... | ... | ... | 1 | 1 |
| 95 | 3 | 4 | 7 | ... | ... | ... | 1 | ... | 1 |
| 100 | 2 | 2 | 4 | ... | ... | ... | ... | 1 | 1 |
| 105 | ... | 3 | 3 | ... | ... | ... | ... | 1 | 1 |
| 110 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 115 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 120 | 2 | ... | 2 | ... | ... | ... | ... | ... | ... |
| 125 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 130 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 135 | 1 | ... | 1 | ... | ... | ... | 1 | ... | 1 |
| Total | 387 | 307 | 694 | 84 | 41 | 125 | 78 | 49 | 127 |

answers, without indicating any real difference in behavior in general. Fraternity men and sorority women check decidedly fewer neurotic answers than nonfraternity people. These results may partly help to establish one of the unknown factors in the selection of fraternity and sorority members. Again, this may or may not represent a true difference between the groups; at least, it no doubt shows a tendency on the part of the fraternity groups to "play safe." Little difference was found between the scores of Jews and gentiles. Some later studies[39] have shown that many items in the Thurstone Attitude Scale contribute little or nothing to the diagnostic value of the scale. Results such as these indicate that much careful work is necessary before any personality scale can be perfected so that it will measure any personality trait effectively.

The *Humm-Wadsworth Temperament Scale*[40] attemps to classify people into types according to Rosanoff's theory of personality. Rosanoff[41] believes that there are five major types of mental disorders. Tendencies toward these disorders are to be found in normal individuals, and these tendencies are the personality characteristics of such people. Using this method as a basis of classification, he lists five major types of personality, two of them with subdivisions. The types are as follows: normal; hysteroid; cycloid, with a manic and a depressed phase; schizoid, with an autistic and paranoid phase; and epileptoid.

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[39] Remmers, H. H., Whisler, L., and Duwald, V. F., "Neurotic Indicators at the Adolescent Level," *Journal of Social Psychology,* Vol. IX (1938), pp. 17–25; and Willoughby, R., "Some Properties of the Thurstone Personality Schedule with a Suggested Revision," *Journal of Social Psychology,* Vol. III (1932), pp. 401–424.

[40] Humm, D. G., and Wadsworth G. W., "The Humm-Wadsworth Temperament Scale," *American Journal of Psychiatry,* Vol. XCII (1935), pp. 163–200.

[41] Rosanoff, A. J., *Manual of Psychiatry,* sixth edition, New York, Wiley, 1927.

Humm and Wadsworth constructed a scale of 318 items. This scale was given to groups of different types of insane patients. Scoring methods were devised by means of a complicated statistical technique (tetrachoric correlation), so that each question had a diagnostic value for classifying people into types. The scale was then given to normal people and norms were derived for seven degrees of each of the following traits: normal, hysterical, cycloid manic, cycloid depressed, schizoid autistic, schizoid paranoid, and epileptoid. Separate quartile norms are presented for college students.

Reliabilities on the test for the different parts range from .70 to .88. The validity of the scale was checked by a comparison of the scores with case studies and clinical records. The validity coefficient was .81 when "biased scales" were included and .98 when normal scales only were used. An interesting variation from the usual testing procedure was introduced into this scale. If there were fewer than 145 or more than 193 *no*-responses, the scale was considered unreliable for such an individual. Scores below or above these limits represent a skewed distribution and such responses are called "biased."

This test has been carefully prepared and checked by elaborate statistical methods. If one is willing to accept Rosanoff's classification, this scale presents a clever method of measuring personality.

The *Thurstone Attitude Scales,*[42] as the name indicates, were intended, not to measure personality traits, but rather to measure differences in attitudes. Attitudes are, as a rule, narrower in scope and more subject to change than personality traits. Thurstone has used a common psychophysical technique in constructing his scales. After selecting the attitude he wishes to measure, he collects a large series of statements about this attitude, being careful that his statements contain both extremes as well as more neutral statements of the attitude. He then has these statements ranked by several people. The ranks given each question are then arranged in order and the median rank is taken as the score value for the question. As a rule, many statements from the original list are eliminated from the final scale, leaving a series about equally spaced in score value from one extreme to the other. The result is a series of statements, generally from twenty-five to fifty in number, which constitutes the attitude scale.

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[42] Thurstone, L. L., and Chave, E. J., *The Measurement of Attitude,* Chicago, University of Chicago Press, 1929. Also Thurstone, L. L., "The Measurement of Opinion," *Journal of Abnormal and Social Psychology,* Vol. XXII (1928), pp. 415–430.

A person taking the test checks all the statements with which he agrees. His score is the median score value of all the items he has checked. Attitude scales have been devised for measuring attitudes toward such varied subjects as censorship, patriotism, evolution, treatment of criminals, prohibition, the observance of Sunday, the Constitution, war, the Negro, the Chinese, the Germans, the law, capital punishment, birth control, communism, the church, and God. There are two or more forms of each of these scales. The reliability coefficient of the attitude scales is generally about .90.

SAMPLE QUESTIONS FROM THE ATTITUDE-TOWARD-GOD SCALE

Put a check (√) if you *agree* with the statement.
Put a double check (√√) if you *agree emphatically*.
Put a cross (×) if you *disagree* with the statement.

( ) 1. I do not believe in God and would be a coward if I pretended to do so.

( ) 2. It is absurd for any thinking man to use such a concept as God.

( ) 3. I trust in God to support the right and condemn the wrong.
( ) 4. I think I believe in God, but really I haven't thought much about it.
( ) 5. I am thrilled in contemplation of the divine Creator.
( ) 6. I am tolerant toward those who still believe in God.

Thurstone and Chave made an extensive study of the scale for the measurement of the attitude toward the church. There are forty-five items in this scale, the scale extending from 0 to 11 values, 0 score being the most favorable to the church. Data were obtained from representative groups of university classes and outside groups. Figure 38 presents their results:

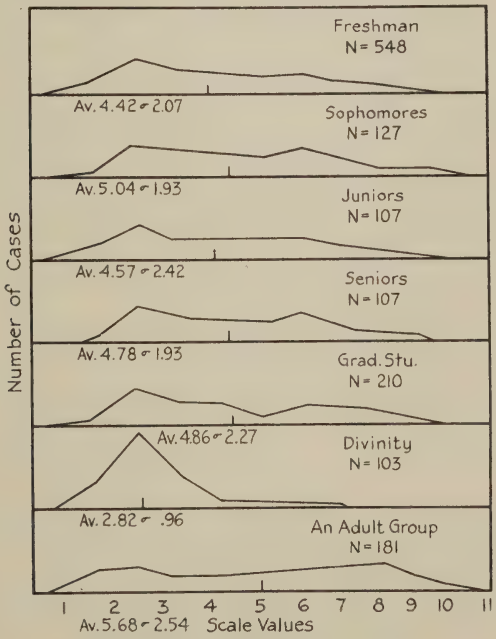

**Fig. 38.**—Thurstone and Chave Measurements of Attitude Toward the Church.

According to these data, divinity students are shown to hold the most favorable attitude toward the church. The freshmen held the next most favorable and the adult group (a Chicago Forum audience) the least favorable attitude. The median college groups checked such items as: "I am interested only to the extent of attending church occasionally" (4.8); "I have a casual interest in the church" (4.9); and "I am neither for nor against the church, but I do not believe that church-going will do anybody any harm" (5.2). It would be interesting to compare these scores with scores from other colleges and universities. The reliability coefficient of the test is given as .85 (corrected by the Spearman-Brown formula to .92).

The *Remmers' Generalized Attitude Scales*[43] consist of lists of statements varying from one extreme to the other. One set applies to institutions, another to social groups, another to occupations, and so forth. Any attitude coming under one of these general headings can be measured by the appropriate scale. Scale values are assigned as in the Thurstone scales. All the scales have been found to have a reliability coefficient of over .80. When used to measure attitudes for which there are also Thurstone scales, the two scales have generally been found to correlate in the neighborhood of .90. Because they can be used for measuring any attitude, the Remmers scales have a more general usefulness than the Thurstone scales.

The *Allport-Vernon Study of Values,*[44] based upon the theory of Eduard Spränger, was mentioned in an earlier part of this chapter. Using Spränger's sixfold classification of values, the authors constructed a test for measuring the relative strength of these values in any individual.

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[43] Remmers, H. H., "Studies in Attitudes," *Purdue University, Studies in Higher Education,* Vol. XXVI; also in *Journal of Social Psychology,* Vol. V (1934), pp. 298–312.

[44] Allport, G. W., and Vernon, P. E., *A Study of Values,* Boston, Houghton Mifflin, 1931; and "A Test of Personal Values," *Journal of Abnormal and Social Psychology,* Vol. XXVI (1931), pp. 231–248.

Sample Question from the Allport-Vernon Study of Values

(Women have an alternative form of this question.)

If you should marry (or are married), do you prefer a wife who:

..4.. (*a*) can achieve social prestige, commanding admiration from others?
..1.. (*b*) likes to stay at home and keep house?
..2.. (*c*) is fundamentally spiritual in her attitude toward life?
..3.. (*d*) is gifted along artistic lines?

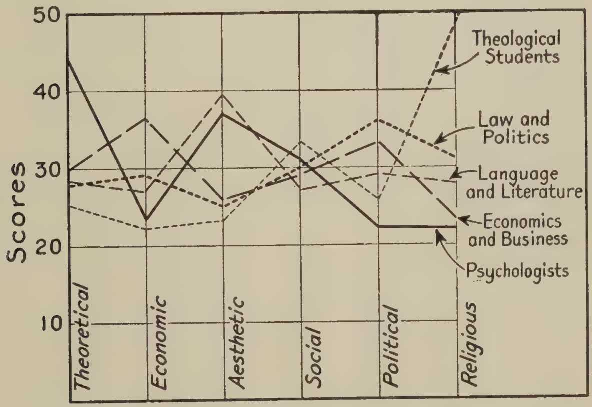

**Fig. 39.**—Allport-Vernon Study-of-Values Scores for Five Different Professional Groups.

The questions are designed to give a person a chance to indicate a devotion to any one or a combination of Spränger's six values, theoretical, economic, aesthetic, social, political, or religious. The questions are carefully weighted and assorted, so that each value has equal opportunity for selection—that is, each value will be chosen equally by an unselected group of people and is so scored that it will receive a score of 30. The total score is always

TABLE XLV

Some Group Scores on the Allport-Vernon Study-of-Values Test

| *Number and Type of Subjects Tested* | *Theoretical Value* | *Economic Value* | *Aesthetic Value* | *Social Value* | *Political Value* | *Religious Value* |
|---|---|---|---|---|---|---|
| Unselected groups of male and female subjects: | | | | | | |
| 463 male college students and adults | 31.49 | 31.28 | 27.61 | 29.68 | 31.88 | 28.07 |
| 313 female college students and adults | 28.04 | 28.72 | 32.47 | 31.42 | 28.0 | 31.37 |
| Selected groups of male subjects: | | | | | | |
| 10 psychologists | 44.5 | 23.1 | 37.0 | 31.0 | 22.4 | 22.0 |
| 26 students of science and medicine | 34.3 | 28.5 | 28.6 | 29.4 | 33.4 | 25.8 |
| 64 students in engineering | 32.0 | 35.1 | 26.1 | 29.0 | 31.4 | 26.4 |
| 43 students of economics and business | 29.6 | 36.5 | 26.9 | 29.1 | 33.2 | 24.8 |
| 14 students of language and literature | 28.8 | 27.0 | 39.6 | 27.2 | 29.2 | 28.2 |
| 18 students of law and politics | 27.6 | 29.2 | 25.0 | 30.3 | 36.5 | 31.4 |
| 13 students of the ministry | 25.7 | 22.3 | 23.3 | 33.5 | 26.0 | 49.2 |
| 17 businessmen in Catholic club | 26.8 | 32 6 | 21.2 | 28.1 | 33.8 | 37.5 |
| 26 Boy Scout leaders | 31.6 | 32.6 | 21.5 | 32.3 | 28.5 | 33.5 |

180. A person with specific interests will indicate these interests by his choice of values. Variations of interests of various groups are shown in the accompanying table. On the basis of the distributions of the 463 unselected males and 313 females, the authors say: "Men are dis-

tinctly more *theoretical, economic* and *political*—the women more *aesthetic, social* and *religious*."

Using the split-half method, the reliability coefficient of the test, for 776 subjects, was .72. In another study, by repeating the test, a reliability coefficient of .82 was obtained. When checked with ratings for validity, correlations ranging from .45 to .59 were obtained.

The *Thorndike Interest Test*[45] was one of the first studies of interests and their permanency. He had a group of Juniors in college rank seven activities as they remembered them from elementary school. They also ranked these same subjects for college interests. The correlations between the rankings for elementary school and college was .60. In a similar test, Willet[46] had high-school students check a series of questions concerning interests for three consecutive years. In contrast with Thorndike, he decided, upon the basis of this study, that the interests of high-school students vacillate greatly from year to year. However, we are here more interested in the problem of the measurement of interests and their variation in individuals. The first intensive work in this field was begun under the direction of C. S. Yoakum, at the Carnegie Institute of Technology, and continued by Cowdry, Ream, Moore, Freyd, Fryer, and Strong.[47] After much further study Strong constructed a test for measuring interests.

The *Strong Vocational Interest Blank* consists of eight parts. Part I contains a list of 100 occupations for which the subject is to indicate, by a check mark opposite, his liking, indifference, or dislike. Part II contains fifty-four amusements; Part III, thirty-nine school subjects; Part IV, fifty-two activities; Part V, fifty peculiarities of people; Part VI, thirty activities, in the order of preference; Part VII, eighty-four comparisons of interest between two items; and Part VIII, ninety ratings of present abilities and characteristics. These are each to be checked as in Part II.

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[45] Thorndike, E. L., "Early Interests, Their Permanence and Relation to Abilities," *School and Society,* Vol. V (1917), pp. 178–179.

[46] Willet, G. W., "Permanence of Pupil Interest," *School and Society,* Vol. VII (1918), pp. 325–33; and Vol. IX (1919), pp. 334–338 and 365–368.

[47] For an extensive account of these studies, see Fryer, Douglas, *The Measurement of Interests,* New York, Holt, 1931.

### Sample of the Strong Vocational Interest Blank

#### *Parts Ia and Ib: Occupations*

Indicate after each occupation listed below whether you would like that kind of work or not. Disregard considerations of salary, social standing, future advancement, and so forth. Consider only whether you would like to do what is involved in the occupation.

Draw a circle around L if you like that kind of work.

Draw a circle around I if you are indifferent to that kind of work.

Draw a circle around D if you dislike that kind of work.

*Work rapidly.* Your first impressions are desired here. Answer all the items. Many of the seemingly trivial and irrelevant items are very useful in diagnosing your real attitude.

| | | | |
|---|---|---|---|
| Actor (not movie) ....... | L | I | D |
| Advertiser ............ | L | I | D |
| Architect .............. | L | I | D |
| Army Officer ........... | L | I | D |
| Artist ................. | L | I | D |
| Astronomer ........... | L | I | D |

#### *Part II: Amusements*

Indicate in the same manner as in Part I whether you like the following or not. If in doubt, consider your most frequent attitude. *Work rapidly.* Do not think over various possibilities. Record your first impression.

| | | | |
|---|---|---|---|
| Golf ................... | L | I | D |
| Fishing ............... | L | I | D |
| Hunting ............... | L | I | D |

| | | | |
|---|---|---|---|
| Tennis ................. | L | I | D |
| Driving an automobile.... | L | I | D |
| Taking long walks....... | L | I | D |

*Part III: School Subjects*

Indicate as in Part II your interest when in school.

| | | | |
|---|---|---|---|
| Algebra ................ | L | I | D |
| Agriculture ............ | L | I | D |
| Arithmetic ............. | L | I | D |
| Art .................... | L | I | D |
| Bible Study ........... | L | I | D |
| Bookkeeping .......... | L | I | D |
| Botany ................ | L | I | D |

Stencils are provided for grading these questions for twenty-eight different occupations.[48] The scoring method for each occupation is based upon a careful analysis of the interests of two or three hundred successful persons in that line of work. Scores are interpreted in terms of letter grades. A grade of A represents a score attained by the highest seventy-five per cent of those in the occupations for which the scoring stencil was prepared; B represents the lowest twenty-five per cent; and C represents scores that are lower than those made by anyone in the occupations. The blank can be used to determine whether a person has occupational interests, even though he has received no training in that occupation. For example, if a young man wishes to know whether he would make a good engineer, he can take the test and have it scored for engineering. If he received a score of A or B, he would know that he had some of the *interests* of engineers. This test would not, however, tell him whether he had the *ability* necessary to become a successful engineer.

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[48] There is now a separate form of the interest blank for women. Scoring stencils are available for eighteen different occupations for the women's blank.

Because of the nature of the method of scoring of the papers, it is impossible to give a distribution of interests. It is possible only to compare the interests of one group with those of another. From Table XLVI we see, for example, that, of the chemists who were scored as having the interests of engineers; forty-seven per cent received A, fifty per cent B, and three per cent C; while of the life-insurance salesmen who were similarly scored, zero per cent received A, twenty-three per cent B, and seventy-seven per cent C. In Table XLVII, fifty-six per cent of the engineers scored as having the interests of chemists received A, thirty-four per cent B, and ten per cent C. Table XLVIII gives further relationships be-

TABLE XLVI

Ratings of Men in Other Occupations in Engineering (Mechanical)

| *Occupational Group* | *Ratings in Engineering* | | |
|---|---|---|---|
| | *A* | *B* | *C* |
| Chemists | 47 | 50 | 3 |
| Farmers | 37 | 49 | 14 |
| Architects | 34 | 54 | 12 |
| Psychologists | 24 | 46 | 30 |
| Surgeons | 22 | 53 | 25 |
| Personnel managers | 19 | 36 | 45 |
| Purchasing agents | 14 | 56 | 30 |
| Public accountants | 13 | 51 | 36 |
| School teachers | 12 | 46 | 42 |
| Lawyers | 8 | 39 | 53 |
| Journalists | 7 | 31 | 62 |
| Artists | 6 | 49 | 45 |
| Real-estate salesmen | 4 | 28 | 68 |
| Authors | 3 | 33 | 64 |
| Ministers | 2 | 25 | 73 |
| Advertising men | 0 | 35 | 65 |
| Life-insurance salesmen | 0 | 23 | 77 |

## TABLE XLVII

### RATINGS OF ENGINEERS (MECHANICAL) IN OTHER OCCUPATIONS

| *Occupation* | *Ratings* | | |
|---|---|---|---|
| | *A* | *B* | *C* |
| Chemistry | 56 | 34 | 10 |
| Farming | 8 | 71 | 21 |
| Architecture | 6 | 57 | 37 |
| Psychology | 2 | 30 | 68 |
| Personnel service | 16 | 54 | 30 |
| Purchasing | 15 | 75 | 10 |
| Accountancy | 0 | 51 | 49 |
| Teaching | 6 | 38 | 56 |
| Law | 2 | 66 | 32 |
| Journalism | 2 | 48 | 50 |
| Art | 0 | 2 | 98 |
| Real-estate salesmanship | 2 | 24 | 74 |
| Ministry | 0 | 17 | 83 |
| Advertising | 0 | 8 | 92 |
| Life-insurance salesmanship | 0 | 14 | 86 |

## TABLE XLVIII

### RATINGS OF MEN IN EIGHT OCCUPATIONS COMPARED WITH RATINGS IN EIGHT OTHER OCCUPATIONS

| *Occupational Group* | *Ratings in Eight Other Occupations* | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *A* | *B* | *A* | *B* | *A* | *B* | *A* | *B* | *A* | *B* | *A* | *B* | *A* | *B* | *A* | *B* |
| Executives | 75 | 25 | 33 | 57 | 17 | 67 | 21 | 67 | 17 | 63 | 0 | 43 | 18 | 64 | 2 | 20 |
| Life-insurance salesmen | 20 | 53 | 10 | 53 | 2 | 24 | 14 | 38 | 23 | 43 | 6 | 28 | 74 | 24 | 0 | 21 |
| Engineers | 14 | 30 | 2 | 29 | 61 | 39 | 6 | 29 | 5 | 25 | 0 | 10 | 0 | 29 | 4 | 29 |
| Lawyers | 13 | 28 | 6 | 20 | 0 | 14 | 23 | 27 | 74 | 24 | 6 | 17 | 10 | 18 | 2 | 9 |
| Certified public accountants | 10 | 35 | 74 | 25 | 2 | 19 | 6 | 17 | 5 | 23 | 0 | 0 | 4 | 12 | 0 | 0 |
| Personnel managers | 6 | 34 | 2 | 33 | 2 | 33 | 75 | 25 | 2 | 43 | 0 | 36 | 2 | 34 | 0 | 0 |
| Ministers | 3 | 19 | 0 | 10 | 2 | 5 | 0 | 27 | 8 | 10 | 76 | 24 | 4 | 8 | 0 | 14 |
| Artists | 0 | 9 | 0 | 4 | 2 | 5 | 0 | 2 | 0 | 5 | 0 | 12 | 0 | 0 | 71 | 29 |

tween occupations. From these results, it is evident that there are close relationships between the interests of some professional groups and little or no relationships between those of other groups.

As a check on the validity of the ratings, a study was made of 156 Stanford Seniors who had definitely decided upon one of fifteen occupations for which scoring stencils were prepared. Of these, forty-six per cent entered the occupations in which they received an A rating and twenty per cent entered the occupations in which they received a B rating.

(3) *Performance tests.* *Army Beta,* a performance test, was constructed during the World War to measure the intelligence of recruits who could not read English. The test consisted of pencil mazes, design completion, and so forth. A method was devised whereby scores on Army Beta could be transmutted into Army Alpha and I.Q. values. This test was in many respects a group test patterned upon the earlier individual performance tests of Pintner and Paterson.[49] The Pintner and Paterson test, like Army Beta, had been constructed for use with persons with language handicaps.

The *Hartshorne-May Deceit, Service, and Self-Control Test*[50] is one of the most carefully controlled investigations of personality by means of performance tests. Deceit is subdivided into cheating, stealing, and lying. Basing their work on an earlier study by Voelker,[51] these experimenters constructed a large battery of tests for measuring these last three traits. Cheating was measured by employing the techniques of copying, duplicating,

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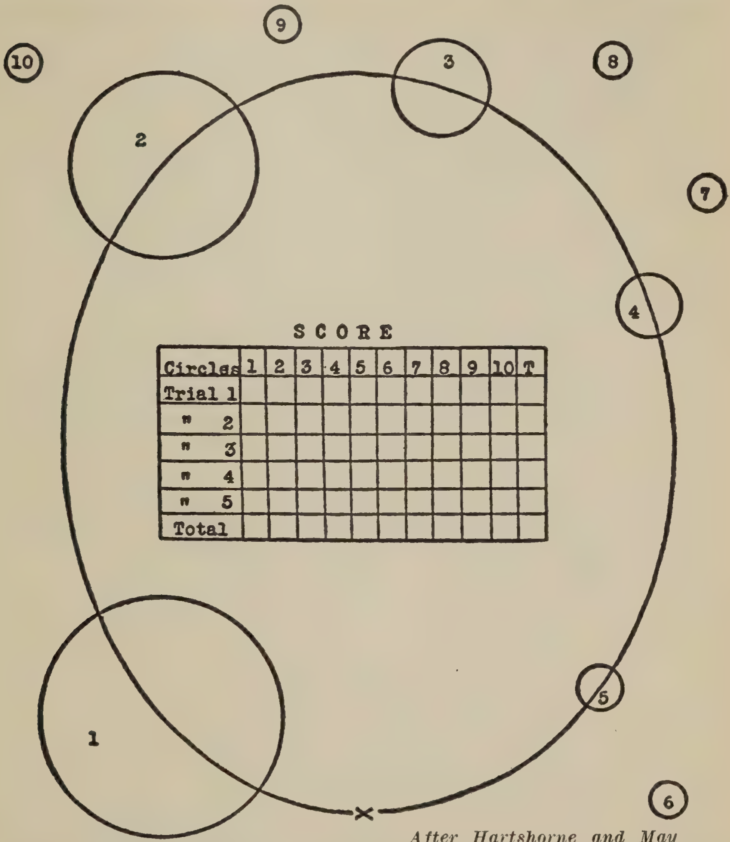
[49] Pintner, R., and Paterson, D. G., *A Scale of Performance Tests,* New York, Appleton-Century, 1917.

[50] Hartshorne, H., and May, M. A., *Studies in Deceit,* New York, Macmillan, 1928.

[51] Voelker, P. F., "The Function of Ideals and Attitudes in Social Education: an Experimental Study," *Columbia University Contributions to Education,* No. 112 (1921).

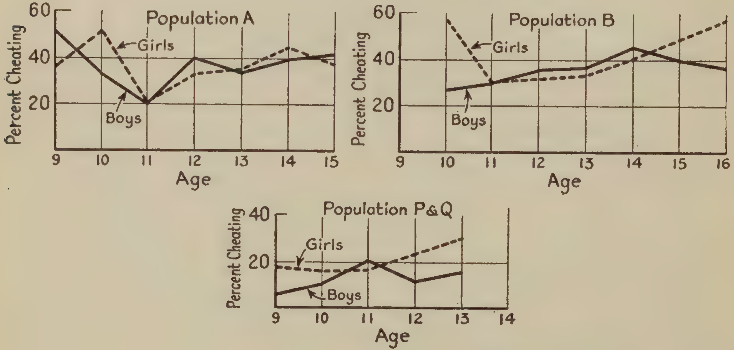


| Circles | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trial 1 | | | | | | | | | | | |
| " 2 | | | | | | | | | | | |
| " 3 | | | | | | | | | | | |
| " 4 | | | | | | | | | | | |
| " 5 | | | | | | | | | | | |
| Total | | | | | | | | | | | |

*After Hartshorne and May*

**Fig. 40.**—Cardboard Test. (Directions: Wait for the signal for each trial. Put the point of your pencil on the cross at the foot of the oval, then, when the signal is given, shut your eyes and put the figure 1 in each circle, taking them in order. For the second trial, put the figure 2 in each circle; for the third trial, the figure 3, etc. After each trial put a check mark in the score box under the number of each circle you succeeded in striking, count the checks, and enter the total in the column headed T at the right of the score box. After the last trial, add up column T. This is your score. The maximum score is 50. Reproduced by permission of the publisher from Hartshorne, H., and May, M. A., *Studies in Deceit,* New York, Macmillan, 1928.)

improbable achievement, and double testing. The first was an ordinary test in which it was possible to cheat but also to estimate the amount of cheating. The second was a paraffin-paper test in which changes in the answers, after they were known by the subjects, were detectable by markings on paraffin paper concealed within the test blank. The third consisted of drawing figures in a set of ten circles with the eyes closed, an impossible task without cheating. The fourth consisted in asking whether the person knew the answers to a set of questions and later asking for the correct answers to these same questions. The tests of stealing consisted of four tests in which money was involved. There were two tests of lying. The reliability coefficient of the honesty tests ranged from .48 to .53 for the individual tests and from .36 to .49 for the group tests. These correlations are not high for reliability coefficients. For the classroom type of test, the reliability coefficient for the deception tests was .72 to .87; for the out-of-classroom type, from .24



*After Hartshorne and May*

**Fig. 41.**—Graphs Showing Percentage of Cheating at Each Age for Boys and Girls. (Reproduced by permission of the publisher from Hartshorne, H., and May, M. A., *Studies in Deceit,* New York, Macmillan, 1928.)

to .77. The lying test had a reliability coefficient of .84.

Much data are presented in the reports of the studies by Hartshorne and May, but it is not presented in a form in which it is easy to bring out individual differences. The preceding figure shows age and sex distributions for three different populations. From these data, it is apparent that there is much more cheating in some populations than in others. Boys cheat more in some populations, while girls cheat more in others. On the average, some boys are found to cheat about three per cent less than girls. This is a small and almost negligible difference. There are also age differences, but these vary from population to population.

Table XLIX shows the percentage of cheating for different intelligence levels, according to the Hartshorne-May tests:

TABLE XLIX

PERCENTAGE OF CHEATING FOR DIFFERENT INTELLIGENCE LEVELS

| *Intelligence Level* | *Percentage of Cheating* |
|---|---|
| A | 21 |
| B | 31 |
| C+ | 30 |
| C | 46 |
| D | 70 |
| E | 82 |

The correlation between intelligence and cheating is –.49. These results are based upon more than 2,000 cases. Other tests of cheating give different results but they all show this same general tendency. While there may be a negative relationship between intelligence and cheating, these results may be spuriously high because of the fact that the more intelligent children more often saw through the tests of cheating and avoided being caught.

The *Sims Socio-Economic Status Test*,[52] as the name indicates, is a measure of the home status from which children come. High scores on the Sims test indicate better home conditions. Table L shows the percentage of cheating based on the Hartshorne-May test when classified according to the Sims socio-economic levels:

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[52] Sims, V. M., *The Measurement of Socio-Economic Status*, Bloomington, Illinois, Public School Publishing Company, 1928.

TABLE L

PERCENTAGE OF CHEATING FOR DIFFERENT SOCIO-ECONOMIC LEVELS

| *Sims Score* | *Percentage of Cheating* |
|---|---|
| 16 | 16.4 |
| 15 | 16.5 |
| 14 | 19.6 |
| 13 | 50.0 |
| 12 | 52.0 |
| 11 | 50.0 |
| 9 | 69.5 |
| 8 | 100.0 |

The correlation between the Sims scores and the Hartshorne-May school cheating test is –.49. That is to say, the better home a child has, the less he will cheat. When intelligence is partialed out, the correlation is reduced to –.40. There is no question but that there is a relationship between social status and scores on tests of cheating. Other studies of race, religion, health, and attendance at motion-picture shows were studied. These data are too complicated, however, for presentation here.

We may summarize by saying that the factors which cause cheating, lying, and stealing are complicated and difficult to discover. No single cause can be assigned to them. Great differences exist between individuals and between groups. Except for intelligence and social standing, the correlation between scores on measures of these moral traits and social and biological factors are low. Furthermore, the correlations between the different tests of moral qualities are low. This is not necessarily due, as usual, to the low reliability of the tests but to the fact that a person may cheat and not lie or steal.

Not only this, but even in honesty there is a great variation from one situation to another. A child may be honest one day and dishonest the next. Verily, character is most difficult to measure and moral behavior as difficult to predict.

The *Moore-Gilliland Aggressiveness Test* is another measure of personality that has been used rather extensively. In its revised form, this test is composed of five parts. Parts I and II consist of a somewhat complicated problem in mental addition. During part of the adding, the person being tested is asked to stare the experimenter directly in the eye. Deductions are made for all eye movements and increased adding time during the staring. Part III is a test in speed of writing. Parts IV and V are association tests in which the score depends upon the kind of association and the time required for a response. The reliability of the test is not as high as might be desired (.75). The validity of the test, when checked by a paired-comparison method and other specially controlled ratings, was found to be very high (.90). The test has been used to select salesmen and has been found to bear some relation ($r = .34 \pm .08$) with grades in public speaking.[53]

**Summary.** We may summarize the results of personality testing, at the risk of considerable repetition, by saying that much remains to be desired in quantitative exactness in this field. While some of the better tests have a fairly high reliability coefficient, it is possible that this coefficient may be somewhat spurious. When the same group of subjects, or part of the group, upon which the test was standardized is used to determine reliability, as has sometimes been done, the results are open to serious question. If the reliability is obtained by retesting, unless the time between the two tests is a month or more, there is much danger of the reliability coefficient representing a memory factor carried over from the first test. A mere lack of recall of the questions and how they were previously answered does not necessarily eliminate the possibility of the memory factor. Evidence of this factor is found from a study of reliability coefficients when the retest is given some time after the first test. In almost all such cases, reliability coefficients are much lower than when the retest follows closely upon the first test. (For example, see the data by McGeoch and Whitley with the Pressey X-O tests.) There may be less criticism of the method of odds versus evens, or one half the test versus the other half, as a method of testing reliability. However, in these cases, a large number of subjects should be used in determining reliability. Generally, it is also worth while to determine reliability on two or three separate groups before being sure that the coefficient obtained is at all near a measure of the true reliability.

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[53] These statements of the reliability, validity, and use of the test are based upon some as yet unpublished data.

Validity is even more difficult to determine than reliability. When the trouble has been taken—and too often it has not—to obtain a coefficient of validity, the basis for validation has generally been personal opinions or ratings. Only in a few cases has anything more objective been used. Not until as much or more care has been exercised in constructing personality tests as intelligence tests will we be able to measure personality and its differences with even a fair degree of success.

Even on good tests the scores from one test cannot be compared directly with the scores on other tests. We cannot say whether a person is more aggressive than he is extrovertive or honest. There may be some possibility of such comparisons when scores are obtained and translated into sigma values. Such attempts, however, have seldom been made.

## Exercises

1. Comment upon the probable degree of variability among men in personality traits. If personality traits were successfully measured, is it likely that the range of many of the distributions obtained would be larger than six sigma (standard deviations)? If men are relatively variable in personality, what is the relative value of sigma?

2. What are some of the factors to consider in order to understand how personality develops?

3. Which physical traits or features appear to have the most direct bearing on personality?

4. What evidence, if any, is there that an active thyroid gland is associated with high intelligence?

5. Name several of the more important endocrine glands and state the physiological result of their over- or underactivity. What are some of the personality correlates of these physiological results?

6. Mention some of the secondary effects which unusual endocrine gland activity may have upon personality.

7. Name several social factors which may have a part in social development.

8. How do economic factors affect personality?

9. What are the five types of maladjustments as outlined by Schaffer?

10. Explain what is meant by saying that personality differences cannot be shown by a simple linear scale. Can differences in height, weight, intelligence, spelling ability, or pitch discrimination be graphed on a single straight line? If so, why cannot personality differences be so graphed?

11. Do all members of our adult population clearly belong to one of the four physical types as defined by Kretschmer? If so, how do you reconcile this with the fact that all degrees of height, weight, and other bodily measurements, from the lowest to the highest, are found in our population? What meaning can be assigned to the word "type" as here used?

12. Explain how body build and insanity may show a positive

relationship as a result of their both being related to the third variable, age.

13. If the relationship between intelligence test scores and body build $r$ is .34, with a P.E. of .06, are we to consider the results as very significant? (Explain the use of P.E.)

14. Is it inconsistent or impossible for a person to develop to a fair degree in each of the six attitudes as listed by Spränger? If a great number of persons of the purely "political type" were assembled, how would you expect them to distribute themselves in respect to any one of the five other attitudes? Give reasons for your answers.

15. Distinguish between the problem of securing an adequate sampling: (*a*) of a trait, when measuring personality traits; and (*b*) of the population, when studying the distribution of a personality trait.

16. Why is a test comprising 300 well-selected words more likely to indicate a person's spelling ability than one comprising but five such words? What difficulty concerning the number of items to be concluded is often met with in constructing personality tests?

17. What are some of the conditions which must be fulfilled in making a test for a personality trait? How is it usually possible to increase the test's: (*a*) reliability; and (*b*) validity?

18. What are the three traditional methods of determining the reliability of a test? Suggest reasons for the fact that the original investigators obtained higher reliability coefficients than later ones.

19. What are personality ratings? How are they used to validate personality tests? Why are they considered of little value for this purpose? Why are they used at all in this capacity?

20. If a perfect personality test were available, would its validity coefficient, obtained by using rating scale results, be 1.00? What would its reliability be?

21. Name and describe the three common methods of securing information about personality traits—*i.e.*, the three personality test methods.

22. What are the three conditions mentioned by Rugg which must be fulfilled in order to have ratings of value?

23. What are the dangers and advantages in scoring a test of 125 items in four different ways, as Bernreuter has done? What conclusion are we to draw if the different scorings show: (*a*) high positive correlations, and (*b*) high negative correlations?

24. Referring to the table of data from the study of Allport and Vernon, give reasons for the fact that all averages are near 30.

25. Describe the construction and scoring of Strong's Vocational Interest Blank.

26. Name performance tests used to measure: (*a*) intelligence; and (*b*) personality traits.

27. To what did May and Hartshorne find cheating related? Name reasons for expecting higher (or lower) relations between cheating and the other variables studies if more nearly perfect measurements were made.

28. If validity coefficients are obtained from the same subjects as were used in determining the score values of different answers to the questions, what type of error is likely to be made? Will validity coefficients probably be too high or too low?

29. If two forms of a personality test are available (a condition seldom obtaining) and both are given in order to determine their reliability, do they need to be given a month or more apart? If the same form is given twice, what should be the time interval between the two administrations?

30. Name all the information which an investigator should give when reporting a reliability coefficient. Why is it that reliability coefficients given alone rarely have very much meaning?

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## CHAPTER XI

# Individual Differences in Learning and Teaching

People differ in their ability to learn. One cause of this difference is due to innate factors in the individual. Some people have more capacity for learning than others, while some spend more time and energy at it. There are also other causes for differences in learning, one of the chief being the method by which a person is taught. It is only within recent years that we have come to realize the importance of differences in methods of teaching, and much remains to be discovered about the best methods of teaching. The first part of this chapter will deal with the differences between individuals in ability and interests in learning; the second, with differences in methods of teaching.

### Differences in Learning

Some indication of the extent of differences in learning have already been suggested in Chapter VIII, on "Differences in Intelligence." In so far as intelligence and learning are similar, the differences in intelligence also hold true for learning. But since the term *learning* is used in a somewhat more specific sense and applies more directly to the effects of training, a further consideration of this topic is needed.

In any discussion of *learning,* it is important to underderstand even more definitely than has already been pointed out what is meant by that term. Not only must it be distinguished from *intelligence* but it must be contrasted as far as possible with *maturation* and *growth. Maturation,* which is closely related to *growth,* refers to those changes which occur as a characteristic of the organism, not as a direct result of experience as such. *Learning,* on the other hand, consists in changes which occur because of experience. Children grow in height and weight, not independently of their environment, but not because of any kind of training; whereas children brought up in a French home learn French because of their experience with French words and usage. Changes which are produced as a result of experience, then, are called *learning.*

Like so many other differences that have been studied, learning varies both in the same individual and between individuals. Variations in learning within the same individual are due, among other things, to changes occurring with age and also to differences in interests and in specific abilities. Differences in learning among people are also due to differences in abilities, interests, and opportunities.

**Age differences in learning ability.** The most comprehensive study of age differences in learning has been made by Thorndike.[1] After surveying the earlier studies, Thorndike make a number of additional investigations of the learning of several different kinds of subject matter as affected by age. In his study, he used groups with superior ability, as well as other groups with average and inferior abilities. The superior group was composed of college students, the average group of students in evening and secretarial schools, and the inferior group of Sing Sing prisoners with little school training. Some of the tasks which Thorndike gave his subjects were: (1) learning to write with the wrong hand; (2) learning to typewrite; (3) learning Esperanto; (4) a substitution test; and (5) learning high-school subjects, such as algebra, civics, English, French, and Latin. In his studies of age differences in learning, Thorndike classified his subjects so that, in any one group, the subjects were comparable in initial ability and in intelligence. While the group with superior intelligence in general learned more rapidly, when compared with those of inferior intelligence of the same age, it was possible to compare the *form* of the learning curve for each group. By combining the various studies, he obtained what he considered the normal rate of learning for ages five to forty-five. This rate is shown in the accompanying diagram:

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[1] Thorndike, E. L., *Adult Learning,* New York, Macmillan, 1928.

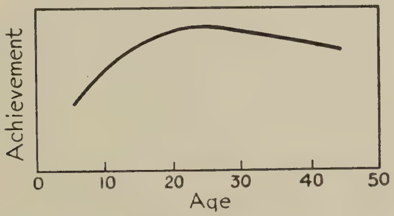


**Fig. 42.**—General Form of the Learning Ability Curve.

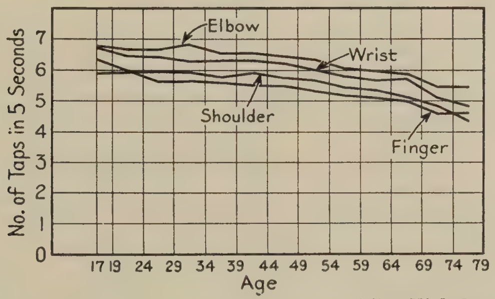
As can be seen from this curve, ability to learn improves rapidly from the age of five up to about the age of twenty. There is little change from twenty to thirty, after which a loss sets in. This loss is slight at first and more rapid later. Since this study does not extend to ages beyond forty-five, no prediction can be made as to the form of the learning curve after that age. Thorndike makes it clear that there is a distinct difference between the ability to learn, his primary concern, and the amount of learning which ordinarily takes place at any age.

Thorndike points out that two common errors are made in assumptions about age changes in learning. The first is due to the fact that the amount of increment at any period is ordinarily compared with the amount already known. For example, the child of seven years may be able to add a few simple numbers. His possibility of improvement is very great. He would only have to learn to add a few more numbers in order to double or quadruple his score. On the other hand, an adult might increase his ability by many times more than the seven-year-old child and still not make a discernible change in his own ability. In the second place, the child generally performs easier tasks in learning than the adult. Hence, his learning proceeds more rapidly. There is no good way of comparing the difficulty of the ordinary tasks that confront a five-year-old, a twenty-year-old, or a forty-five-year-old. Yet it is true that the tasks for the older ages are ordinarily many times more difficult than those for the younger ages. This fact is often neglected in comparing age differences in learning. Only when the tasks are identical or similar can direct comparisons be made between the learning of different age groups.

There has been a general belief that some tasks are more easily learned at some periods in life than at others. Most people do not learn to speak a foreign language without an accent after ten years of age. There is also some evidence that mathematics is taught too early in the school grades; if the child were allowed a year or two more than usual for maturation before he is taught multiplication, division, and fractions, he could learn these subjects with much less effort.

**Age changes in different kinds of learning.** By studying age changes in learning different types of material, it has been found that the changes are not the same for all types. Valuable as any study of the general form of the learning curve is, it must be remembered that averages often conceal very important differences. By averaging the rate of learning for such tasks as performing simple sensori-motor feats, memorizing a poem, and solving puzzles, differences between these tasks have been lost. A few studies in age changes in learning different kinds of material will now be reviewed.

In a study of the rate of speed of tapping, Nicholson [2] found considerable change in rate for different ages between seventeen and seventy-nine. Twenty-five males and twenty-five females were tested for each year. The following graph (Figure 43) gives the average rate of tapping for a five-second interval, when tapping was performed by shoulder, elbow, wrist, and finger movements:



*After Nicholson*

**Fig. 43.**—Loss in Tapping Rate with Age.

Although the younger subjects were high-school and college students, while the older subjects were volunteers secured at such places as state and county fairs, the variation in intellectual ability probably had little effect upon scores in tapping. The loss in tapping rate from age interval seventeen to nineteen years to that of forty-nine to fifty-four years was, on the average, less than nine per cent; and the total average loss from seventeen to seventy-nine years was less than twenty-five per cent. This is not so great a loss in efficiency as that found by Miles[3] in changes in reaction time for the finger and foot, and in a more complicated motor task of following a moving light with a stylus.

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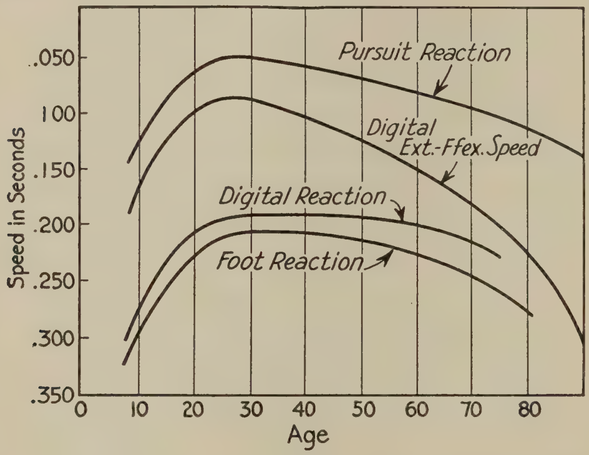
[2] Thorndike, E. L., *Adult Learning,* New York, Macmillan, 1928.



*After Miles and Miles*

**Fig. 44.**—Graph Showing Changes in Rate of Four Different Kinds of Motor Reactions with Age.

Several studies have been conducted to measure the change with age in ability to solve problems and to reason. A study by Ruch[4] has already been mentioned in Chapter VIII. He constructed three types of learning problems, which were presented to people of three different ages. One type of learning was a common problem of associating one word with another, for example: *cat—rat, horse—carriage.* The second consisted in associating one nonsense syllable with another. The third involved unlearning one thing in order to learn another; for example: 3 × 4 = 11. The different age groups ranged from twelve to seventeen, thirty-four to fifty-nine, and sixty to eighty-two. Forty subjects were used in each age group. The results are given in terms of the percentage of overlapping of the older group with the average of the youngest group. For example, only 25.8 per cent of the middle group and 10.8 per cent of the oldest group reached the average of the youngest group in learning meaningful associations. The results are presented in Table LI below:

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[3] Miles, W. R., "Correlation of Reaction and Coördination Speed with Age in Adults," *American Journal of Psychology,* Vol. XLIII (1931), pp. 377–391.

[4] Ruch, Floyd, "The Differentiating Effects of Age upon Human Learning," *Journal of General Psychology,* Vol. II (1934), pp. 261–286.

TABLE LI

AGE CHANGES IN LEARNING

| *Type of Learning* | *Youngest Group* | *Percentage of Overlapping of Middle Group* | *Percentage of Overlapping of Oldest Group* |
|---|---|---|---|
| Meaningful material ..... | 50.0 | 25.8 | 10.8 |
| Nonsense material ....... | 50.0 | 30.8 | 7.5 |
| Interference material ..... | 50.0 | 22.5 | 2.5 |

The above data show, not only that the oldest group was seriously handicapped in learning, but also that it was more handicapped in types of learning where old habits were least useful. Where old associations were a handicap, as when something learned had to be unlearned, the oldest group was almost helpless. This falls in line with the conservative nature of the group and its tendency to cling to the past, both so characteristic of old age. As long as old methods and habits are successful, the older person may be nearly, if not fully, as efficient as a younger person; but when it comes to opening up new enterprises, and in an age of change at that, old age is at a serious disadvantage in the race of life. From these studies, it is apparent that the rate of increase or decrease in ability with age varies for different tasks. The question now is: How may these seemingly conflicting results be interpreted?

The nature of learning is, apparently, not a function of one variable only; it comprises several elements. In one learning situation, one element may dominate in such a way as to produce one kind of learning; in another situation, another element or combination of elements may produce a different type of age changes in learning. Not all the elements in learning can be easily determined, though a few of them are rather apparent. Especially in motor learning, as in tapping, speed of movement is one of the most important factors. Another element in motor learning is fatigue. Fatigue reduces efficiency more rapidly in the earlier and later ages than during early maturity and middle age. Rate of movement and fatigue are also important factors in mental tasks. Whether the same kind of speed is involved in tapping and in mental tasks, such as educational or intelligence tests, is debatable; nevertheless, age changes in these tasks are affected. Strength is a factor in motor learning. It is more important in some tasks than in others. Children and old men are not hired or, if hired, are paid low wages for manual labor. Just as strength affects production, so does it affect learning in situations in which strength is an important factor. In more complex kinds of skill, such as baseball, not only speed of movement and strength but coördination of movement is important. Very few professional baseball players remain in the big leagues beyond the age of forty. Miles' study of complex motor skills showed a similar rapid decline after forty in a pursuit meter test. In mental tasks where previous experience is an important factor, Lorge has shown that there is little loss in mental ability as such, at least before the age of sixty. If speed is enforced in mental tasks, there is a loss in efficiency in the later years of life. Ruch's study emphasizes the fact that old age is a serious handicap in learning where new types of learning are demanded or where old facts must be unlearned before new ones can be acquired. Thorndike has also called attention to the fact that interests in other things, lack of interest in acquiring new skills or knowledge, as well as the fear of defeat in competition with others, are factors which ordinarily keep older people from learning or from being able to compete successfully in learning.

When all these facts are kept in mind, it is clear that learning capacity varies with different tasks and that the rate of learning varies for different tasks at different age levels. Some tasks require a preponderance of one kind of ability, which may or may not be almost as great at one age as another. Other tasks depend more upon some other abilities, which may be greatly deficient either in youth or old age or in both.

**Other variations in learning in any individual.** In addition to age changes, there are other differences in learning ability within any individual. A person may be very able at learning mathematics but very poor at learning a language or at learning to play a piano. The whole issue of whether there is any relationship between human abilities is a confused one. As already mentioned, Spearman believes there is an interrelation of mental abilities. Thurstone has analyzed mental abilities and finds evidence for seven independent kinds of ability involved in mental tasks. But man also learns tasks that call for very little mental ability. These are among what Spearman calls the "special abilities." There must be many special abilities and little or no relationship between most of them. Besides these differences in ability, as has been mentioned before, men differ also in interests. Since interests so profoundly affect learning, any analysis of learning must include a study of the interests and the related subject of motives.

It is fortunate for mankind that, since abilities and interests are so diversified, life presents so many kinds of opportunities and demands so many kinds of work. Because of this fact, there is a much greater chance for more people to succeed. One person has an interest and ability in one kind of work; another could not succeed in that field but finds another in which he can succeed. It is unfortunate that we know so little about man and that we can do so little in helping him in his interests and abilities. Another difficulty is that our economic and social system often does not permit man to utilize his best abilities and interests.

**Differences in learning between individuals.** It is not necessary to dwell upon the fact that people differ in ability to learn, but it is important to know something about the extent of these differences. The difficulties involved in solving this problem are much the same as those in measuring changes within one individual. Only when the same or equivalent materials are used in learning can accurate comparisons be made. The amount of difference in learning between individuals varies with the task, the amount of learning which has already taken place, and possibly with the age of the learner. Other factors, such as interest and motivation, cannot be eliminated from any learning situation. With so many variables, it is apparent that it is very difficult to compare individuals in learning.

Almost every experiment in the field of learning where groups of people have been used for subjects presents

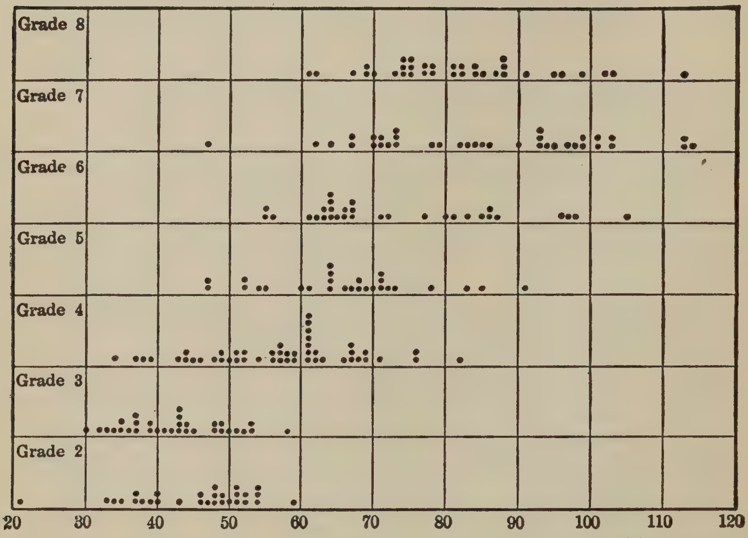
TABLE LII

Relation of Poorest to Best Performance of 107 Ninth-Year Pupils on Each of 34 Psychological Tests

| *Nature of Test* | *Author* | *Lowest Score* | *Highest Score* | *Ratio of Lowest to Highest Score* |
|---|---|---|---|---|
| Information (group) | Terman | 1 | 19 | 1:19 |
| Best answer (group) | Terman | 0 | 22 | ? |
| Logical selection (group) | Terman | 0 | 16 | ? |
| Arithmetic (group) | Terman | 0 | 18 | ? |
| Sentence meaning (group) | Terman | 0 | 18 | 1? |
| Analogies (group) | Terman | 3 | 17 | 1:5.7 |
| Mixed sentence (group) | Terman | 0 | 16 | ? |
| Classification (group) | Terman | 7 | 17 | 1:2.4 |
| Number series (group) | Terman | 0 | 22 | ? |
| Word meaning (group) | Terman | 0 | 30 | ? |
| Motor reaction (shorthand) | Hoke | 27 | 90 | 1:3.3 |
| Speed of writing (shorthand) | Hoke | 14 | 73 | 1:5.2 |
| Immediate memory (shorthand) | Hoke | 15 | 88 | 1:5.8 |
| Quality of writing (shorthand) | Hoke | 30 | 90 | 1:3 |
| Speed of reading (shorthand) | Hoke | 20 | 68 | 1:3.4 |
| Spelling (shorthand) | Hoke | 8 | 60 | 1:7.6 |
| Symbols-speed (shorthand) | Hoke | 14 | 75 | 1:5.6 |
| Speed of decision (group) | Downey | 2 | 10 | 1:5 |
| Coördination (group) | Downey | 0 | 10 | ? |
| Freedom from load (group) | Downey | 2 | 20 | 1:10 |
| Motor inhibition (group) | Downey | 1 | 10 | 1:10 |
| Volitional perseveration (group) | Downey | 3 | 16 | 1:5.3 |
| Interest in detail (group) | Downey | 2 | 10 | 1:5 |
| Motor impulsion (group) | Downey | 0 | 3 | ? |
| Self-confidence (group) | Downey | 1 | 10 | 1:10 |
| Non-compliance (group) | Downey | 0 | 9 | ? |
| Finality of judgment (group) | Downey | 0 | 10 | ? |
| Easy directions | Woodworth and Wells | 4 | 20 | 1:5 |
| Cancellation (*a*-test) | | 37 | 82 | 1:2.2 |
| Vocabulary | | 4 | 34 | 1:8.5 |
| Dotting squares | Henmon | 40 | 138 | 1:3.4 |
| Arithmetic (addition) | Courtis | 0 | 16 | ? |
| Arithmetic (multiplication) | Courtis | 0 | 14 | ? |

differences in learning. Manifestly, it is impossible to review all such studies or even any large number of them here. One of the earlier studies in which standardized material was used is reported by Hull.[5] He gives the results of a study of 107 ninth-grade pupils tested on thirty-four psychological tests.

The last three columns of Table LII give the lowest and highest scores, together with the ratio of lowest to highest scores, for these different tests. These ratios



*After Starch*

**Fig. 45.**—Graph Showing the Distribution and Overlapping of Pupils in Writing. (Speed and quality are combined into one score, as explained in Starch, Daniel, *Educational Measurements,* New York, Macmillan, 1916. The numbers along the horizontal axis represent speed and quality in terms of speed—*i.e.,* letters per minute. Quality was measured by the Thorndike scale. Reproduced by permission of the publisher from Starch, Daniel, *Educational Psychology,* New York, Macmillan, 1927.)

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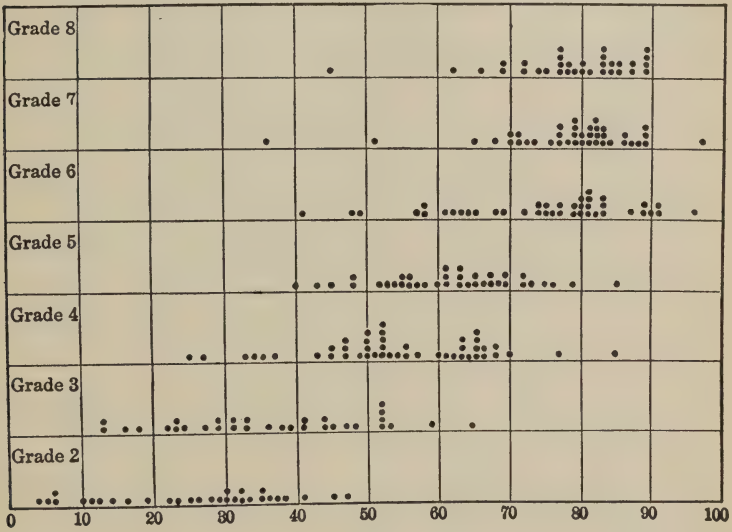
[5] Hull, C. L., *Aptitude Testing,* New York, World Book Company, 1928, p. 34.

ranged from 1:2.2 to 1:19, the median ratio of the lowest to the highest pupil being 1:5.2. If the tasks had had a greater range of difficulty, the differences no doubt would have been greater. The differences are also probably not so great as they would have been for an unselected group, because the least intelligent children do not attend school.

Another way in which differences in learning can be illustrated is by the use of standard educational tests.



*After Starch*

Fig. 46.—Graph Showing the Distribution and Overlapping of Pupils in Spelling. (Numbers along the horizontal axis represent the number of words spelled out of a list of 100. Reproduced by permission of the publisher from Starch, Daniel, *Educational Psychology,* New York, Macmillan, 1927.)

Although the studies were made several years ago, Starch[6] gives a very good idea of the extent of differences in school subjects. Figures 45 and 46 give the distribution and overlapping for handwriting and spelling for Grades II to VIII in one school. Figure 47 gives the distribution and overlapping for the different school subjects when they are averaged together. These graphs show not only the wide distribution in ability in each grade in a typical school but also that many pupils in

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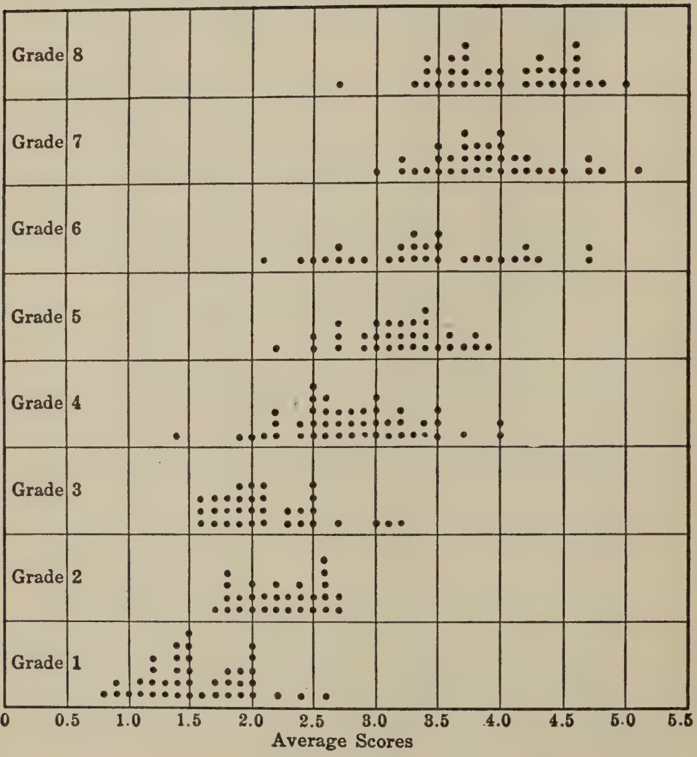
[6] Starch, D., "The Measurement of Efficiency in Handwriting," *Journal of Educational Psychology,* Vol. VI (1915), pp. 106–114; "The Measurement of Efficiency in Spelling," *Journal of Educational Psychology,* Vol. VI (1915), pp. 127–186; and *Educational Psychology,* revised edition, New York, Macmillan, 1927, p. 48.



*After Starch*

**Fig. 47.**—Graph Showing the Distribution and Overlapping of Pupils when Their Attainments in Different Subjects Are Averaged. (Reported in a Thesis by Helen Craig in the library of the University of Wisconsin, 1918. Reproduced by permission of the publisher from Starch, Daniel, *Educational Psychology,* New York, Macmillan, 1927.)

Grade IV, for example, are higher in attainment on standard tests than others in Grade VIII. Starch summarizes these results as follows: "The best pupil in reading or spelling or any school subject is from one and a half to twenty-five times as capable as the poorest pupil." This suggests that the best pupil can learn a unit of work in from two thirds to one twenty-fifth the time required by the poorest pupil to do the same amount of work. In spite of the tendency for such ratios to be too large, because of the frequent use of arbitrary zero in educational tests, the ratios do indicate great differences among school children.

While such studies do not separate the various factors which cause differences in learning between people, they do, however, show something about the extent of these differences. In the next section of this chapter, some of the more important educational methods for providing for differences in learning will be outlined.

## Differences in Teaching

In the preceding sections of this text, the facts of individual differences have been set forth. Only more or less incidental references have been made to the practical applications of this information. In the present section of this chapter, special emphasis will be placed upon the application of the facts of individual differences to problems of school administration, curriculum construction, and methods of teaching.

It is to be remembered that our first schools were very cosmopolitan in character. Some minister or other person who was able to read, write, and do simple arithmetic set up a school and invited children to come to his home for instruction. The school was open to anyone, regardless of age, who was able to pay the tuition charges. As time went on, standards were gradually established for teachers. Teaching became a profession, at least in the sense that people devoted their full time to it and received some sort of compensation for their work. But for a long time all grades of pupils were taught by the same teacher. In fact, this was the common practice in all but the urban schools up to the twentieth century and continues to be a very common practice in many of our rural schools at the present time.

For many years, pupils in our urban schools have been classified into eight grades, with a separate teacher provided for each grade. Most urban schools now contain one or more rooms for each grade, from Grades I to VIII. However, there is much heterogeneity in the ordinary school grade, as is well illustrated by the following chart (Figure 48). In a typical sixth-grade room of forty pupils in Philadalphia, Boyer[7] shows that the chronological ages vary from one pupil aged ten or less to six aged fourteen or more. The mental age varies from eight who are two or more years over age to six who are two or more years under age. In the various school subjects, the distributions are just as great, always with an educational range of four years or more in every school subject within a single grade.

However, certain serious difficulties have been sensed both in the highly heterogeneous ungraded schools and in the graded schools where chronological age or the amount of schooling has been made the main basis of grade placement. There has been a rapidly growing realization of the importance of differences between children. This has led to certain investigations which, in turn, have

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[7] Boyer, Phillip A., *Thirty-Fifth Yearbook,* National Society for the Study of Education, Bloomington, Illinois, Public School Publishing Company, p. 193.

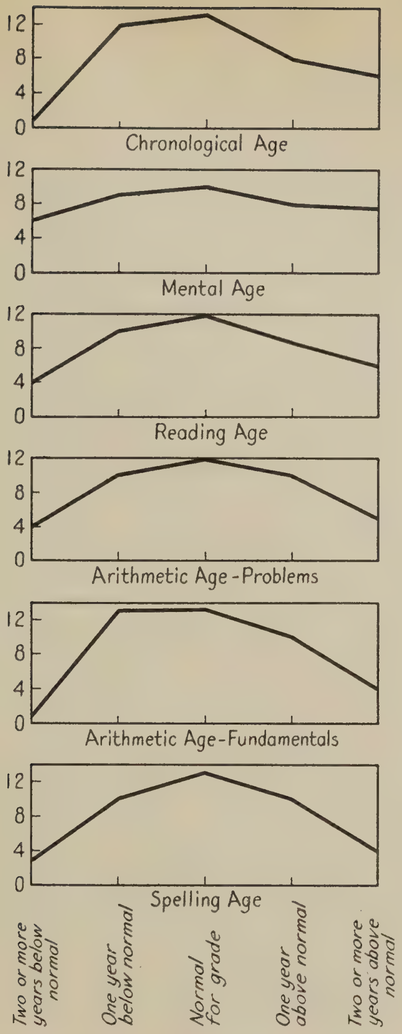

**Fig. 48.**—Distribution of Chronological, Mental, and Educational Ages. [These graphs show how a class of 40 children would be distributed on the basis of chronological age, mental age, and achievement tests (the latter four graphs). For example, in chronological age, 1 pupil would be two or more years below normal; 12, one year below normal; 13, normally placed; 8, one year above normal; and 6, two or more years above normal.]

greatly modified school organization and practices. Let us consider some of these movements and their effects on the schools.

In 1904, Alfred Binet and Theodore Simon were given the practical problem of determining which pupils in the Paris schools needed special instruction.[8] Thus, the whole field of intelligence testing is really an outgrowth of this assignment by the Minister of Public Instruction to these two men. As was also pointed out in the first chapter of this text, the construction by Rice,[9] in 1895, of a spelling scale marked the beginning of work in the field of standardized educational tests. Ayres[10] first clearly called attention to the problems of retardation and the extent of school failures, together with the great cost in pupil's and teacher's time. These three studies were among the first significant modern investigations of individual differences, and all three have direct educational implications. It is through studies such as these that many changes have been made in school organization and practice.

**Provisions for individual differences in the schools.** The application of the facts of individual differences to school problems is made with respect to the age at which children enter, progress through, and leave school; and to the arrangement of the school program in order to solve the problems arising from the various abilities, interests, and needs of pupils.

We know that children enter school at different ages and with differing abilities. Some years ago, Terman[11] made a study of the mental ability of 149 children near Palo Alto upon entering school. These children varied in chronological age from five years seven months to eleven years. As shown in Table LIII, they varied in mental age from four years to over nine and a half years:

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[8] Binet, Alfred, and Simon, Theodore, "Sur la necessité d'établir un diagnostic scientifique des états inférieurs de l'intelligence," *L'Année Psychologique,* Vol. XI (1905), pp. 163–190.

[9] Rice, J. M., "The Futility of the Spelling Grind," *The Forum* (1897), pp. 163 and 409.

[10] Ayres, L. P., *Laggards in Our Schools,* New York, Russell Sage Foundation, 1909.

TABLE LIII

Mental Age of 149 Children in First Grade

| *Mental Age* | *Number of Cases* |
|---|---|
| 4.0–4.4 | 9 |
| 4.5–4.9 | 17 |
| 5.0–5.4 | 20 |
| 5.5–5.9 | 14 |
| 6.0–6.4 | 21 |
| 6.5–6.9 | 30 |
| 7.0–7.4 | 26 |
| 7.5–7.9 | 6 |
| 8.0–8.4 | 4 |
| 8.5–8.9 | 2 |
| 9.0–9.4 | 0 |
| 9.5–up | 3 |

It is probable that these pupils are typical and that there has not been a great change in variability of the mental age of children entering school in the last several years.[12]

The Chicago School Survey[13] compared the age of children entering school in Chicago with the average practice in eighteen other cities. Table LIV gives a summary of these results. Children vary in age of entering the first grade from four and a half years up. While the median age is six years, there is a large variation on each side of this central tendency. There are, of course, a few children who never go to school. Some of these do not have the ability necessary for schoolwork, while others live in communities where school attendance is difficult or where its importance is not stressed.

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[11] Terman, L. M., *The Intelligence of School Children,* Boston, Houghton Mifflin, 1919.

[12] See Berry, C. S., "The Classification of Ten Thousand First Grade Pupils," *Journal of Educational Research,* Vol. VI (1922), pp. 185–203; and Bonar, H. S., "Segregation of Ability Groups and Achievement on the First Grade Level," *Educational Methods,* Vol. XI (1932), pp. 531–536.

[13] Strayer, George D., *A Survey of the Schools of Chicago,* New York, Columbia University, 1932.

TABLE LIV

PERCENTAGE OF PUPILS ENROLLING IN THE FIRST GRADE

| *Age* | *Percentage of Kindergarten Pupils* | | *Percentage of Nonkindergarten Pupils* | |
|---|---|---|---|---|
| | *Average practice* | *In Chicago* | *Average practice* | *In Chicago* |
| 4½ | .0 | .1 | .0 | .1 |
| 5 | .6 | .2 | 1.3 | .3 |
| 5½ | 4.9 | 4.1 | 4.4 | 3.6 |
| 6 | 56.7 | 66.8 | 33.0 | 49.0 |
| 6½ | 24.9 | 23.9 | 28.2 | 28.3 |
| 7 | 8.3 | 3.1 | 15.2 | 10.7 |
| 7½ | 2.4 | 1.3 | 7.0 | 4.8 |
| 8 | .9 | .3 | 3.0 | 1.8 |
| 8½ | .5 | .1 | 5.2 | .6 |
| 9 or more | .8 | .1 | 3.0 | .8 |
| | 5.5 | 4.4 | 5.4 | 4.0 |
| Underage | 81.6 | 90.7 | 61.2 | 77.3 |
| Normal | 12.9 | 4.9 | 33.4 | 18.7 |
| Overage | | | | |

The upper limit for school attendance is generally in terms of an age limit ranging from fourteen to eighteen years or of a school grade attainment (generally the eighth grade) or a combination of the two. This age limit affects those with limited ability or lack of interest in school, compelling them to attend school longer than they otherwise would. The brightest children may complete the elementary and high-school program before the upper school age limit is reached. However, this group seldom presents a serious problem in school attendance.

These variations in the age of entrance to and withdrawal from school are partly a result of individual differences in ability or interest in school and are, themselves, a factor in causing changes in these same differences. Children with unusual ability who enter school early and remain long improve more than the average. Those with limited ability who attend less than the average are benefited less. There are some with unusual ability who attend school less than average and there are those with less than average ability who attend more than the regular amount of time. However, it is improbable that these last two groups are as common as the first two. In other words, school training is generally assumed to increase differences rather than reduce them.

In addition to the differences in age of entrance to school, there are the differences in age within the various school grades. Differences in age within any grade—for example, the sixth—are almost as great as those in the age of entrance to school. Table LV, after Odell, gives the distribution of ages in each of the grades in urban schools of the State of Illinois, as well as the percentage of children at age, underage, and overage. Such a table is called an *age-grade table*. Tables like this one, which is typical, show not only the wide range of ages in each grade but also the fact already mentioned, namely, that many more children are overage than underage.

The principal means for providing for individual differences in the schools may be classified under the three main heads of : (1) administrative provisions; (2) curricular provisions; and (3) method provisions. However, it is difficult to decide in some cases under which classification

## TABLE LV

### Age-Grade Table for All City Schools in Illinois for 1922

| Grade | Age | | | | | | | | | | | | | | | | | | | | | Total | Median Age | Average Over-ageness | Percentage under-age | Percentage at age | Percentage over-age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | | | | |
| I... | 78 | 1731 | 4525 | 1216 | 310 | 84 | 33 | 16 | 6 | 5 | 4 | 1 | 1 | ..... | ..... | ..... | ..... | ..... | ..... | .... | ..... | 8010 | 6.49 | .09 | 25 | 49 | 26 |
| II... | .. | 58 | 1378 | 3458 | 1454 | 462 | 165 | 54 | 25 | 14 | 8 | 4 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | .... | ..... | 7080 | 7.61 | .27 | 23 | 41 | 35 |
| III... | .... | 1 | 67 | 1234 | 3206 | 1510 | 647 | 257 | 123 | 47 | 22 | 5 | 3 | ..... | 2 | 1 | ..... | ..... | ..... | .... | ..... | 7125 | 8.71 | .40 | 21 | 37 | 32 |
| IV... | .... | .... | 1 | 94 | 1181 | 2911 | 1528 | 758 | 315 | 127 | 57 | 25 | 2 | 1 | ..... | 1 | ..... | ..... | ..... | .... | ..... | 7001 | 9.76 | .51 | 21 | 34 | 45 |
| V... | .... | .... | .... | 9 | 92 | 1005 | 2655 | 1602 | 848 | 417 | 177 | 78 | 16 | 3 | 1 | ..... | ..... | ..... | ..... | .... | ..... | 6903 | 10.88 | .66 | 19 | 32 | 49 |
| VI... | .... | .... | .... | .... | 3 | 87 | 983 | 2324 | 1473 | 819 | 405 | 147 | 22 | 3 | ..... | ..... | ..... | ..... | ..... | .... | ..... | 6266 | 11.89 | .62 | 20 | 30 | 50 |
| VII... | .... | .... | .... | .... | .... | 5 | 73 | 933 | 2247 | 1398 | 813 | 343 | 67 | 13 | 1 | ..... | ..... | ..... | ..... | .... | ..... | 5893 | 12.86 | .56 | 20 | 31 | 49 |
| VIII... | .... | .... | .... | .... | .... | .... | 7 | 100 | 976 | 1985 | 1280 | 554 | 154 | 28 | 6 | ..... | ..... | ..... | ..... | .... | ..... | 5092 | 13.74 | .37 | 24 | 31 | 44 |
| IX... | .... | .... | .... | .... | .... | .... | .... | 8 | 130 | 685 | 1282 | 763 | 301 | 104 | 23 | 10 | 2 | 1 | ..... | 1 | ..... | 3310 | 14.65 | .27 | 27 | 30 | 43 |
| X... | .... | .... | .... | .... | .... | .... | .... | .... | 7 | 94 | 515 | 967 | 539 | 193 | 63 | 12 | 4 | ..... | ..... | .... | ..... | 2394 | 15.60 | .19 | 29 | 32 | 40 |
| XI... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 14 | 75 | 419 | 686 | 358 | 131 | 25 | 7 | ..... | 1 | .... | ..... | 1716 | 16.51 | .07 | 33 | 31 | 36 |
| XII... | .... | .... | .... | .... | .... | .... | .... | .... | 1 | .... | 8 | 66 | 316 | 539 | 248 | 58 | 11 | 2 | 1 | .... | 1 | 1251 | 17.43 | —.04 | 36 | 33 | 30 |
| Total | 78 | 1790 | 5971 | 6011 | 6246 | 6064 | 6091 | 6052 | 6151 | 5605 | 4646 | 3372 | 2107 | 1242 | 475 | 107 | 26 | 3 | 2 | 1 | 1 | 62041 | .... | .43 | 23 | 36 | 42 |
| Average grade. | 1.00 | 1.03 | 1.25 | 2.04 | 2.89 | 3.75 | 4.62 | 5.50 | 6.43 | 7.24 | 8.00 | 8.95 | 10.14 | 10.97 | 11.20 | 11.10 | 10.89 | 11.00 | 11.50 | 9.00 | 12.00 | .... | .... | .... | .. | .. | .. |

*After Odell*

a provision should be placed, while in other cases it is clear that the provision belongs partly to one and partly to another. Since the provisions differ somewhat in the lower grades and in high schools, and still more so in colleges and universities, the discussion will be classified under the latter headings.

(1) *Provisions for individual differences in the elementary schools.* One administrative device which has been used rather extensively for providing for differences in the abilities of elementary-school pupils is that of *flexible promotions.* The simplest provision for flexible promotion is half yearly or even quarterly promotions, instead of the older annual promotions. There is nothing about more frequent promotions that makes grade placement inherently better by that means than by annual promotions, although such is likely to be the case. If the bright child has two opportunities to be advanced instead of only one, there is more chance that he will be advanced; or, if a child fails in a half grade, the loss is not so great if the work can be repeated in the next half year. Therefore, there will be more deviation from regular promotions when the promotion steps are smaller. Despite the serious administrative difficulties involved, some school systems divide the year into two parts and promote semiannually. While the large majority of children are promoted to another grade at the end of the school year, some are promoted or demoted at the middle of the year. Although the flexible promotion plan has much to commend it, it seems to be decreasing rather than increasing in popularity. This is probably due to the administrative difficulties involved in having classes promoted at midyear rather than to any criticism of its educational advantages.

Another administrative device for taking care of individual differences is the *multiple-track plan.* By this plan, the children in a certain school system are classified into two or more groups. One group, composed of the brighter pupils, takes more than the regular quota of work or does the work in less than the usual amount of time. Another group moves more slowly, generally taking more than the regular eight years to complete the eight grades. There are several variations of such plans which provide sections for both superior and dull as well as average pupils. These plans are all fairly easy to arrange in large school systems where there are several sections for each grade; in small school systems, however, they either necessitate extra teachers or that the teacher divide the class into two or three sections and teach each separately. In any sectioning plan, there is the problem of how to select the different groups. Various methods have been used, such as teachers' opinions, intelligence tests, standard achievement tests, or a combination of these. All have been used with varying degrees of success. Miller and Otto[14] have analyzed nine different studies of homogeneous grouping. Their results do not show any decided advantage for such grouping, unless the curricula for the different groups are varied. Unfortunately, in most school systems, the course of study for the grades is so well standardized and routinized that it is difficult to adapt materials and methods to pupils of different levels. However, in a later publication, after a very thorough survey of methods of homogeneous grouping and its results, Otto[15] came to the general conclusion that grouping has definite advantages over the traditional methods of chance or alphabetical placement of pupils in different classes in the same grade.

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[14] Miller, W. S., and Otto, H. J., "Analysis of Experimental Studies in Homogeneous Grouping," *Journal of Educational Research,* Vol. XXI (1930), pp. 95–102.

[15] Otto, H. J., *Elementary School Organization and Administration,* New York, Appleton-Century, 1934, Ch. V.

There are several types of the *individualized instruction plan.* Some of these plans can be summarized as modified tutorial plans. Then there are also some specialized plans, such as the Winnetka and Dalton plans, in which the curriculum is different from that of the ordinary school. In the Winnetka plan,[16] the subject matter of the course of study is divided into two parts. The work of one half of the school curriculum, dealing largely with the knowledges and skills which everyone is expected to master, is grouped into units. The children must develop a certain proficiency in each unit before they may pass on to the next unit. For example, in spelling, the child must acquire a certain proficiency in one list of words before he may pass on to the next list. The rate of progress is entirely individualized. A child may progress at one rate in one subject and at a different rate in another subject. Special texts have been prepared and special teaching devices constructed for this plan. Under this plan, there is no class recitation; the teacher spends her whole time teaching. There are no failures and no skipping of grades, the child beginning in September where he left off in the spring. In the other half of the school curriculum, the children work together in group projects. The social studies, the arts, and hand skills are taught during these periods. The chief exponent of the Winnetka plan, C. W. Washburne, says that there are three steps by which this type of individualized instruction is to be accomplished. First, the specific purposes or aims which are to be accomplished must be determined. A certain amount of arithmetical knowledge, for example, must be acquired before passing on to the next unit. That is, the child must be able to do long-division problems involving a two-place divisor and a four-place dividend with a naught at the end of the answer or a remainder and requiring the use of a trial divisor, or problems of similar difficulty, at the rate of two in three minutes with 100 per cent accuracy. Second, diagnostic tests must be used to determine when these units are acquired or what parts have been accomplished and what parts have not. These tests are to be elaborate and detailed. The use of the tests is to displace the ordinary classroom recitation. Third, the materials for instruction must be specially prepared. Since there are no recitations, the subject matter must be presented in a form which the child can assimilate. This often necessitates special textbooks. The materials must be self-instructive. Many instructions and directions must be prepared and given to the pupils. Washburne claims that, when such steps are taken, the Winnetka plan can be used in any school system or in any room in a school system, regardless of whether others use the plan or not and whether the school is large or small, city or rural. The Dalton plan is not dissimilar from the Winnetka plan, in that the work of the school is broken up into units. Instruction is correspondingly individualized. The work is organized into projects and the school is looked upon as a laboratory for the completion of these projects.

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[16] Washburne, C. W., *Adjusting the School to the Child,* New York, World Book Co., 1932.

One of the most common *method devices* is linked up with the grouping of children according to ability. When children are so grouped, different programs and different methods of instruction are often used with the various groups. The following program, taken from *Tentative Course of Study in Arithmetic, Kindergarten and Grades I–IV,* by the Central Committee of Cleveland Public Schools, gives a sample assignment for three groups in third-grade arithmetic in Cleveland:

### Course of Study in Arithmetic

### Third Grade — B Section

| *X-Group* | *Y-Group* | *Z-Group* |
|---|---|---|
| **A.** Counting, beginning with any intermediate number, by 2's, 5's, and 10's to 100. By 3's and 4's to 50. | **A.** Counting, beginning with any intermediate number, by 2's, 5's, and 10's to 100, and 3's to 30. | **A.** Counting by 2's, 5's and 10's to 100; 3's to 30. |
| **B.** Addition and subtraction as follows: | **B.** Addition and subtraction as follows: | **B.** Addition and subtraction as follows: |
| 1. The hundred fundamental combinations. | 1. The hundred fundamental combinations. Complete combinations not taught in Grade II.<br>6 7 8 8 9 9 9 9 9<br>7 8 5 6 4 5 6 7 8 | 1. Combinations not taught in 2A, as follows:<br>8 9 6 7 8 9 7 8<br>3 3 4 4 4 4 5 5 |
| 2. Addition by endings, as:<br>8 18 28 38<br>7 7 7 7 etc. | 2. Addition by endings:<br>8 18 28 38<br>7 7 7 7 etc. | 2. The hundred fundamental combinations. |
| 3. One-, two-, and three-column additions to five addends. | 3. One-, two-, and three-column additions to four addends. | 3. Additions by endings:<br>8 18 28 38<br>7 7 7 7 etc. |
| 4. Subtraction with borrowing, two- and three-place numbers. | 4. Subtraction without borrowing, two- and three-place numbers. | 4. One-, two-, and three-column additions to three addends. |
| GOAL — By the end of the third grade the pupil should be able to subtract as follows:<br>420 8 from 10=2<br>128 2 from 11=9<br>292 1 from 3=2 | GOAL — By the end of the third grade the pupil should be able to subtract as follows:<br>429 8 from 9=1<br>118 1 from 2=1<br>311 1 from 4=3 | |
| 5. Checking addition by adding in reverse order. | 5. Checking addition by adding in reverse order. | 5. Subtraction without borrowing, two- and three-place numbers. |

### Course of Study in Arithmetic—*(Cont.)*

### Third Grade — B Section

| *X-Group* | *Y-Group* | *Z-Group* |
|---|---|---|
| | | GOAL — By the end of the third grade the pupil should be able to subtract as follows:<br>435 3 from 5=2<br>123 2 from 3=1<br>312 1 from 4=3 |
| 6. Checking subtraction by addition. | 6. Checking subtraction by addition. | 6. Checking addition by addition in reverse order. |
| 7. Adding and subtracting dollars and cents. | 7. Adding and subtracting dollars and cents. | 7. Checking subtraction by addition. |
| | | 8. Adding and subtracting dollars and cents. |
| **C.** Multiplication and division as follows: | **C.** Multiplication and division as follows: | **C.** Multiplication and division as follows: |
| 1. All products of 0 to 5 inclusive, times 0 to 10 inclusive, and reverse; all quotients without remainders resulting from dividing 1 to 45 by 1 to 5. | 1. All products of 0 to 5 inclusive, times 0 to 10 inclusive, and reverse; all quotients without remainders resulting from dividing 1 to 45 by 1 to 5. | 1. Tables of 1's, 2's, 5's, 10's and the division facts. |
| 2. Multiplication of two- and three-place numbers by 1 to 5. | 2. Multiplication of two- and three-place numbers by 1 to 5. | 2. Multiplication of two- and three-place numbers by 1, 2, and 5. |
| 3. Short division, three-place numbers by 2, 3, 4, and 5, no carrying. | 3. Checking multiplication by repetition. | 3. Checking multiplication by repetition. |
| 4. Checking multiplication by repetition. | | |
| 5. Checking division by multiplication. | | |
| **D.** Fractional parts as follows: | **D.** Fractional parts as follows: | **D.** Fractional parts as follows: |
| ½, ⅓. ¼, and ⅕ of an object or a small group of objects. | ½, ⅓. ¼, and ⅕ of an object or a small group of objects. | ½ and ⅕ of an object or a small group of objects. |

In addition to the regular groups in any school system, there are those that do not fit into any such group.

Those who are handicapped mentally, physically, or emotionally come under this category. Some idea of the size and importance of these latter groups can be gained from the following account, taken from the *Survey of the Schools of Chicago*,[17] by George D. Strayer and others:

> Out of an elementary school population of about 500,000, Chicago has 163 classes for mentally handicapped, 2 schools for crippled children only, and parts of 2 elementary schools for crippled children, 6 prevocational schools, classes in 68 elementary schools for children of lowered vitality, classes for the deaf and hard of hearing in 9 schools, classes for the blind and partially sighted in 18 schools, rooms for truant children in 7 elementary schools and 2 prevocational schools, 2 special schools for truant boys and a great variety of classes in hospitals, orphanages, juvenile detention homes and other types of remedial institutions.

Any adequate discussion of the methods of teaching special classes would take us too far afield at this point. The reader who is interested in this problem is referred to the many texts on this subject.[18] Suffice it to say here that some of the devices for the slower pupils consist of handwork and other types of manual activity, bare minimum essentials in school subjects, and much drill. Then there is also the problem of special methods for the superior child. Not so much has been done on this subject as with subnormal and handicapped children. Some writers advise no special methods for the superior child but suggest that he be accelerated in his schoolwork.

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[17] Strayer, George D., *op. cit.*, Vol. II, p. 4.

[18] Hollingworth, L. S., *Gifted Children, Their Nature and Nurture*, New York, Macmillan, 1926; Scheideman, Norma V., *The Psychology of Exceptional Children*, Boston, Houghton Mifflin, 1931; Wallin, J. E. W., *The Education of Handicapped Children*, Boston, Houghton Mifflin, 1924; and Witty, P. A., and Beeman, F. N., "Practices in Special Classes," *Educational Trends*, Vol. I, No. 1 (January 1932), pp. 4–6.

Others advocate an enriched curriculum for the superior child. This problem will receive further consideration in a later part of this chapter.

Progressive education methods have been sponsored in this country by the Progressive Education Association, formed in 1918, which bases its ideas primarily upon the philosophy of Dewey[19] and Kilpatrick[20] and partly on the practices of some English private schools. Although the association represents many divergent points of view and many variations in practice, at least a few cardinal principles of the movement can be stated as the basis of its revolt against present educational methods and also of the ideals toward which it is striving. The following are a few of the most important general principles of the movement. In so far as these principles are carried out in school practice, they involve both curricular provisions and methods provisions:

(*a*) Education consists in the activity of the child in processes which are vital to him. This is well summarized by Kilpatrick,[21] as follows:

> The traditional position is essentially that of a curriculum composed of subject-matter-set-out-to-be-learned. (Some critics object to this compound term, but many proponents of the activity movement feel that it points with admirable precision to the essential difference between the two positions.) In accordance with this, *study* is essentially the effort to acquire what is thus set out; *learn* is its successful acquisition. The test of success is whether the learner can give back on demand what has thus been set out. The teacher must set the assignment, require its acquisition (peacefully, if he can; forcibly, if he must), then test the acquisition, and promote or fail accordingly. On this position,

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[19] Dewey, John, *Schools of Tomorrow,* New York, Dutton, 1919.

[20] Kilpatrick, W. H., "The Essentials of the Activity Movement," *Progressive Education,* Vol. XI (1934), pp. 346–349.

[21] Kilpatrick, *loc. cit.*

obvious pupil virtues are willingness to be told, study hard, learn well, and recite accurately. Scientific (measuring) education, at its outset, accepted this general position. It sought to do these things. The only difference was to do them better. While many present-day adherents have varied from the old spirit, this is in logic the original and clear-cut position.

Opposed to this we have a quite different position, as seen by those who most thoughtfully hold it. They wish the child to be more nearly self-directed, believing that only as he practices on his stage of intelligent self-direction can he learn to be more intelligently self-directing. That this may be possible, they further believe that the desirable school life should, in this respect, take on more of the quality of the best life outside of school. They therefore seek to have pupils engage in desirable purposeful activity, where the ends thus set up are the pupil's own and are felt and pursued as such. On this basis, *study* is the personal effort to deal intelligently with the situation at hand. Learning follows from study but includes all resulting changes in the person (organism) as he thus works at the situation before him. Study and learning are now seen as inherent in the meaningful life process. What is learned is *not* set up in advance but accompanies and follows the efforts at meeting the situation, being called out by these efforts. "Subject-matter," if we still use that term, includes on the study side all that one pays attention to or uses in the prosecution of the experience, and on the learning side all the learning results of all sorts. The school curriculum on this position does not consist of matter set-out-in-advance-to-be-learned, but of the succession of educative experiences so far as the school accepts responsibility for them. An "activity" thus means any distinguishable instance of such meaningful experience.

(*b*) Learning consists in the addition of new responses to the reacting organism. From this point of view, learning is creative; it consists in combining the innate abilities of the organism with organized meanings to produce "effectual intelligence." The aim and glory of education is to increase this "effectual intelligence." This is fundamentally a *Gestalt* approach to learning.

Learning, then, consists in the modification of the whole organism as a result of insight.

(*c*) Learning is a self-directed purposeful activity on the part of the pupil. It is the teacher's place to help the pupil in this purposeful activity. The emphasis here is shifted, so that the pupil becomes the central factor and the teacher, the textbook, and the classroom function only as aids in the process. By this arrangement, the pupil is given much freedom, the teacher merely exercising a sort of guidance function in the educative process.

(*d*) Interest is the motivating factor in learning. The child has many interests, and it is the function of the teacher to work with the child in discovering and in expressing these interests. The place of interest in learning is not new; Herbart stressed its importance more than a hundred years ago. But this "activity-movement" plan, as it is sometimes called, reëmphasizes interest and makes it the central theme in education. The traditional organization of the school and the methods of teaching must be almost completely revised to take account of the interests of the child. Where these ideas are put into practice in the schools, it means no formal classroom exercises, no lecturing by the teacher, no regular textbook assignments, and no separation of subject matter into units. Instead, there are a number of student projects or interests, which are worked out by the pupils under the guidance of the teacher. This investigation may take the child into the traditional fields of arithmetic, history, geography, art, or any other field of knowledge. No distinctions are made concerning the sources from which the information is derived. In so far as these interests can be worked out in the group project, they constitute the "core" curriculum. This only means that the children work together on group projects, but each with his own approach to the problem under study. Special interests of the children call for special smaller groupings or individual study.

(*e*) The object of learning is the development of the child's personality rather than the accumulation of facts. The child is to be made an intelligent contributing member of an advancing society. This does not deny the importance of facts and information but regards them as important only in so far as they contribute to the child's developing personality.

These are not all the principles held by many of the members or adherents of the progressive education movement; some of them are not even held by all who would consider themselves "progressive." It has already been stated that the practical application and effectiveness of these principles in school practice vary greatly from school to school and even from one teacher to another. This is not the place to criticize the movement either favorably or unfavorably. No doubt anyone will agree with many of its precepts. Some of them are not particularly new; others are new in emphasis only. Some of the principles will not be accepted by many students of education, at least as they are being put into practice today. Our main concern here is in what ways this movement emphasizes individual differences. In the first place, the individual interests of the pupils are recognized as in no other plan. It may almost be said that the whole concept revolves around the idea of the individual nature of the interests of children and the significance of these interests in the learning and teaching process. Second, in practice, this concept emphasizes individualized instruction. Although the children may meet together, each works along his own lines of study and investigation. In the third place, the purpose of education becomes the development of personality. Each individual will develop a personality in accordance with his own abilities and interests and the way these grow through his experiences with life. As pointed out in Chapter X, it is personality which most distinguishes one person from another.

(2) *Provisions for individual differences in the high school.* The plans here discussed will refer primarily to those used in senior high schools, although occasionally similar methods are being employed in junior high schools also. In some cases, these methods are not essentially different from those used in elementary schools. However, high schools differ from elementary schools in several respects, namely: the age of the groups; the length of the school course—three or four years as contrasted with from six to eight years; the different kinds of programs offered, such as classical, commercial, and technical courses; and specialized and varied instruction in different school subjects.

In 1932, the National Survey of Secondary Education published the results of a study[22] of the various means of providing for individual differences in secondary schools. This report was based on a study of 8,594 high schools in this country. The list was a representative sampling from all parts of the country and for all kinds and sizes of schools. Table LVI gives a summary of the results of this study, showing the frequency with which various provisions for individual differences were in use and the estimated success of these methods, as reported by superintendents, principals, supervisors, and teachers:

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[22] Billett, Roy O., "Provisions for Individual Differences, Marking, and Promotion," *National Survey of Secondary Education Monographs,* No. 13, Bulletin No. 17 (1932), United States Department of the Interior.

## TABLE LVI

### Frequencies with Which Various Provisions for Individual Differences Were Reported in Use, or in Use with Estimated Unusual Success, by 8,549 Secondary Schools

| *Nature of Provisions* | *Provisions in Use* | | *Provisions in Use with Estimated Unusual Success* | | *Ratio of Number of Provisions in Use to Number in Use with Estimated Unusual Success* |
|---|---|---|---|---|---|
| | *Number* | *Per cent* | *Number* | *Per cent* | |
| 1. Variation in number of subjects a pupil may carry | 6,428 | 75 | 795 | 9 | 0.12 |
| 2. Special coaching of slow pupils | 5,090 | 59 | 781 | 9 | .15 |
| 3. Problem method | 4,216 | 49 | 444 | 5 | .10 |
| 4. Differentiated assignments | 4,047 | 47 | 788 | 9 | .20 |
| 5. Advisory program for pupil guidance | 3,604 | 42 | 540 | 6 | .15 |
| 6. Out-of-school projects or studies | 3,451 | 40 | 439 | 5 | .13 |
| 7. Homogeneous or ability grouping | 2,740 | 32 | 721 | 8 | .26 |
| 8. Special classes for pupils who have failed | 2,612 | 30 | 350 | 4 | .13 |
| 9. Laboratory plan of instruction | 2,611 | 30 | 323 | 4 | .12 |
| 10. Long-unit assignments | 2,312 | 27 | 349 | 4 | .15 |
| 11. Project curriculum | 2,293 | 27 | 365 | 4 | .16 |
| 12. Contract plan | 2,293 | 27 | 465 | 5 | .20 |
| 13. Individualized instruction | 2,145 | 25 | 309 | 4 | .14 |
| 14. Vocational guidance through exploratory courses | 1,911 | 22 | 186 | 2 | .10 |
| 15. Educational guidance through exploratory courses | 1,900 | 22 | 193 | 2 | .10 |
| 16. Scientific study of problem cases | 1,343 | 16 | 146 | 2 | .11 |
| 17. Psychological studies | 1,077 | 12 | 70 | 1 | .06 |
| 18. Opportunity rooms for slow pupils | 946 | 11 | 172 | 2 | .18 |
| 19. Morrison plan | 737 | 9 | 175 | 2 | .24 |
| 20. Special coaching to enable capable pupils to "skip" a grade or half-grade | 726 | 8 | 114 | 1 | .16 |
| 21. Promotions more frequently than each semester | 686 | 8 | 103 | 1 | .15 |
| 22. Remedial classes or rooms | 593 | 7 | 90 | 1 | .15 |
| 23. Adjustment classes or rooms | 544 | 6 | 55 | 1 | .10 |
| 24. Modified Dalton plan | 486 | 6 | 52 | 1 | .11 |
| 25. Opportunity rooms for gifted pupils | 322 | 4 | 69 | 1 | .21 |
| 26. Restoration classes | 191 | 2 | 24 | 0 | .13 |
| 27. Dalton plan | 162 | 2 | 15 | 0 | .09 |
| 28. Winnetka plan | 119 | 1 | 14 | 0 | .12 |
| 29. Other techniques | 101 | 1 | ... | ... | ... |

Billet classifies the twenty-eight provisions listed in his table under seven categories, as follows: homogeneous grouping; special classes; plans characterized by the unit assignment; scientific studies of problem cases; variations in pupil load; out-of-school projects and studies; and advisory or guidance programs. These different types of provisions and the various devices designed to effectuate them will be discussed in the following pages.

*Homogeneous grouping* of pupils is one of the most frequently listed methods of providing for individual differences. It is much more commonly used in the larger than in the smaller schools. Over thirty per cent of all high schools represented in Billett's study mentioned this method, and about seventy-five per cent of all schools with over 250 pupils report its use.[23] By means of standard tests, Billett[24] studied the advantages of homogeneous grouping for slow, average, and fast groups. From this study, he says it is apparent that such grouping *materially assists the slow group,* has little effect upon the average group, and hinders the progress of the fast group. Others have suggested that when methods are adapted to the superior group, as they have been for the others, the superior group will gain as much or more by grouping than the slow group. More recently, a committee of the National Society for the Study of Education made an extensive survey of the problem of grouping.[25] The majority of the committee was favorable to some form of grouping. However, in summarizing the many studies, Miss Cornell[26] says: "A review of the objective results of ability grouping leaves one convinced that we

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[23] A more recent survey by Harap indicates that there may be a decrease in this percentage, although the evidence is not conclusive. See Coxe, W. W., *et al.,* "The Grouping of Pupils," Thirty-Fifth Year-*book,* Part I, National Society for the Study of Education, p. 162, 1936.

[24] Billett, Roy O., "The Administration and Supervision of Homogeneous Grouping," *Ohio State University Contributions in School Administration,* No. 4 (1929).

[25] *Ibid.,* p. 290.

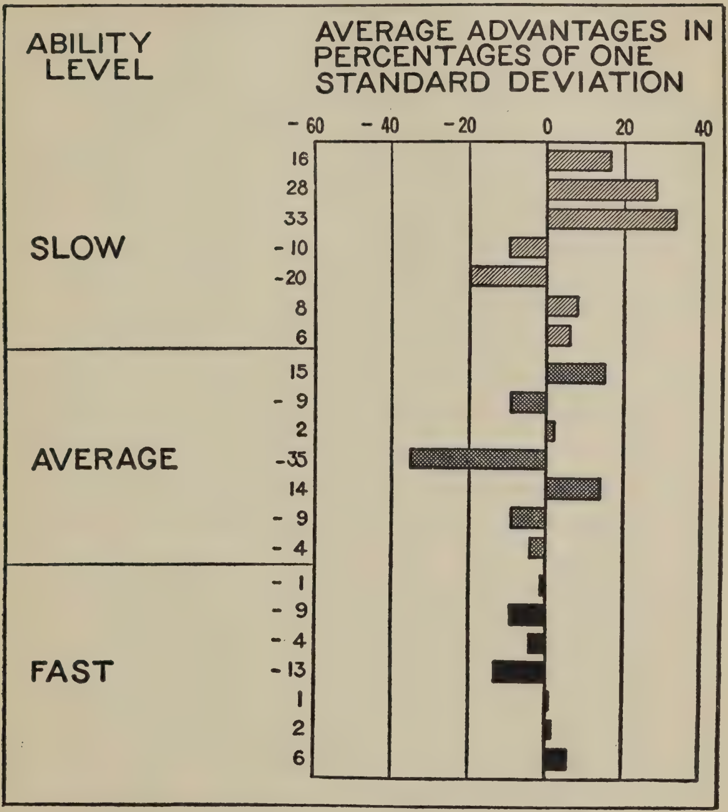

**Fig. 49.**—Graph Showing the Average Advantage per Test, in Terms of Standard Deviations, for Each Ability Level in Each of Seven Experiments Conducted in Ohio. (Reproduced by permission of the publisher from Billett, Roy O., "Provisions for Individual Differences, Marking, and Promotion," *National Survey of Secondary Education Monograph No. 13,* Bulletin No. 17, Washington, D. C., United States Government Printing Office, 1933.)

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[26] *Ibid.* The chapter by Miss Cornell contains an excellent bibliography of the experimental studies of grouping.

have not yet attained any unequivocal experimental results that are capable of wide generalization. As Wyndun says: 'The first general impression one gains from these studies is that . . . they raise more issues than they settle.' " Miss Cornell is nevertheless of the opinion that homogeneous grouping has some values not easily measured in the usual ways, such as improvements in attitude, social adjustments, and interests of the pupils. She also shows that the reaction of teachers who have worked with grouping, as well as of parents and pupils, is more often favorable than unfavorable.

Several schools use various kinds of *individualized instruction.* Although the Winnetka plan was devised for the elementary grades, some secondary schools have adopted it. The Dalton plan, or some modification thereof, according to *The National Survey of Secondary Education,*[27] is used in about eight per cent of the high schools. Still other schools have laboratory or project method plans offering more or less individualized instruction.

*Semiannual promotion* is probably more common in high schools than in grade schools. This presents a better opportunity for more rapid promotion or demotion.

The method of providing for individual differences most commonly reported in Billett's study[28] is the *variation in pupil load*—that is, variation in the number of subjects a pupil may carry at one time. Seventy-five per cent of all the schools reporting mentioned this method. It is well distributed over the country and in all types of high schools, except that it is more common in the larger than in the smaller schools. The length of the course and the length of the recitation period are fairly well standardized in high schools; so also are the number of subjects which the average pupil takes at any one time. However, it is not uncommon for the best pupils to be allowed to take five subjects and in some cases as many as six subjects. That is possible for some children to do so is shown by the experience in the James Monroe High School, in New York City. A study in this school showed that those who were permitted to carry six majors failed but half as often as those who carried five majors and that neither of these groups failed as often as those who carried a regular load of four majors. Pupils who carry more than the usual quota can either complete the high-school course in less than four years or they can graduate with excess credit. These excess credits may be used by those who plan to attend college, since many colleges accept students from high school with advanced standing for the equivalent of as much as one year's college work. In contrast with those pupils who carry more than the average load, there are those who carry less. These may be people with limited ability or poor health, those who work outside of school, or those who, for any other of many reasons, do not or are not able to carry the full load but have a desire to continue in school. A study conducted in sixty high schools by the North Central Association of Colleges and Secondary Schools showed fifty per cent of the pupils carried a regular load of four subjects, fifteen per cent up to five and a half subjects, and seven per cent more than five and a half subjects. On the other hand, sixteen per cent carried from two and a half to four subjects, and twelve per cent carried less than two and a half subjects.

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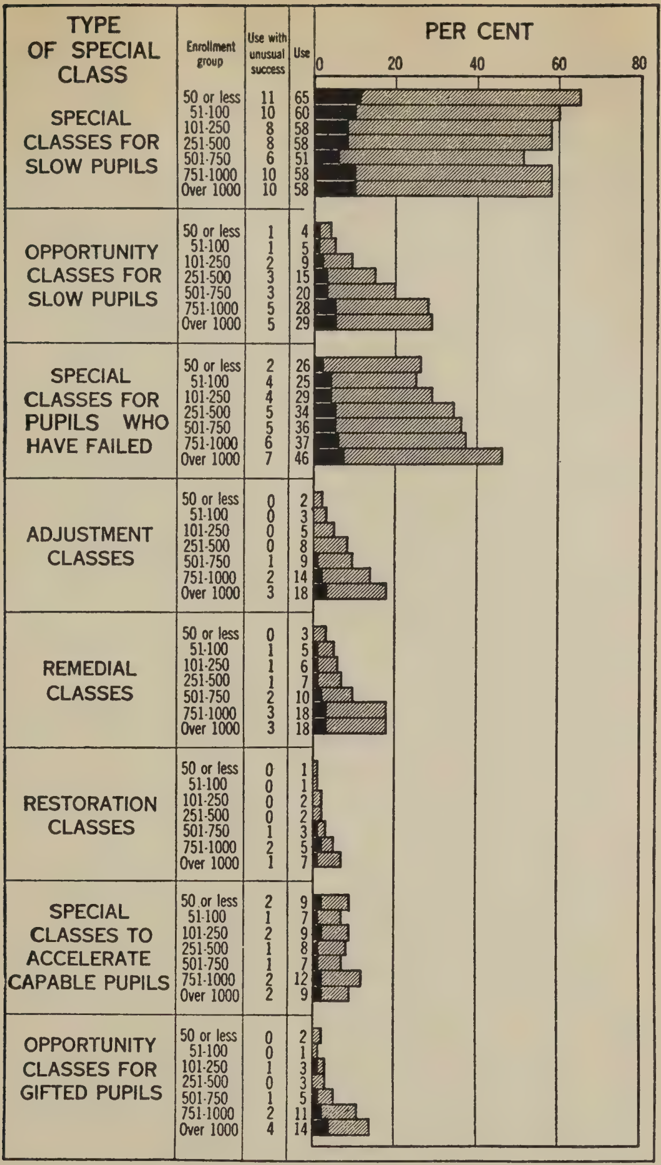
[27] Billett, Roy O., "Provisions for Individual Differences, Marking, and Promotion," *National Survey of Secondary Education Monographs,* No. 13, Bulletin No. 17 (1932), United States Department of the Interior.

[28] *Ibid.*

Another device designed to care for individual differences, which is much more common in high schools than in elementary schools, is *multiple curricula.* Most small schools and practically all large high schools have more than one curriculum. In some cases, this goes so far that we have whole high schools devoted to one type of program. There are commercial high schools, technical high schools, and classical high schools. Even within these specialized schools, several different curricula are to be found. This allows the pupil to make adjustments for his needs, abilities, and interests. In order to make the best use of these varying curricula, some method of *pupil guidance* is necessary. Many high schools have vocational and educational advisers. In so far as these systems of guidance function efficiently, the pupils are assisted in making wise choices and benefiting from the opportunities for differentiated programs of study.

There is one other device common enough to warrant mention. This consists in various kinds of *out-of-school work.* Some of the pupils are allowed to carry more than the regular load or carry courses not regularly taught. One of the most common out-of-school projects is agricultural in character, as provided for in the Smith-Hughes Act. Instrumental music courses come next; then a multitude of other projects. Forty per cent of all the high schools have some form of out-of-school projects.

If the concept of method device is broadly construed so as to include *special classes,* Figure 50 will show how extensively the latter are used. It is interesting in this connection to note that special methods classes are about ten times as common for slow pupils as for bright pupils. We are still devoting our time to keeping pupils from failing rather than to training our brightest pupils according to their ability. In the larger high schools, this special work for the slow pupils is generally provided in special



| TYPE OF SPECIAL CLASS | Enrollment group | Use with unusual success | Use |
|---|---|---|---|
| SPECIAL CLASSES FOR SLOW PUPILS | 50 or less | 11 | 65 |
| | 51-100 | 10 | 60 |
| | 101-250 | 8 | 58 |
| | 251-500 | 8 | 58 |
| | 501-750 | 6 | 51 |
| | 751-1000 | 10 | 58 |
| | Over 1000 | 10 | 58 |
| OPPORTUNITY CLASSES FOR SLOW PUPILS | 50 or less | 1 | 4 |
| | 51-100 | 1 | 5 |
| | 101-250 | 2 | 9 |
| | 251-500 | 3 | 15 |
| | 501-750 | 3 | 20 |
| | 751-1000 | 5 | 28 |
| | Over 1000 | 5 | 29 |
| SPECIAL CLASSES FOR PUPILS WHO HAVE FAILED | 50 or less | 2 | 26 |
| | 51-100 | 4 | 25 |
| | 101-250 | 4 | 29 |
| | 251-500 | 5 | 34 |
| | 501-750 | 5 | 36 |
| | 751-1000 | 6 | 37 |
| | Over 1000 | 7 | 46 |
| ADJUSTMENT CLASSES | 50 or less | 0 | 2 |
| | 51-100 | 0 | 3 |
| | 101-250 | 0 | 5 |
| | 251-500 | 0 | 8 |
| | 501-750 | 1 | 9 |
| | 751-1000 | 2 | 14 |
| | Over 1000 | 3 | 18 |
| REMEDIAL CLASSES | 50 or less | 0 | 3 |
| | 51-100 | 1 | 5 |
| | 101-250 | 1 | 6 |
| | 251-500 | 1 | 7 |
| | 501-750 | 2 | 10 |
| | 751-1000 | 3 | 18 |
| | Over 1000 | 3 | 18 |
| RESTORATION CLASSES | 50 or less | 0 | 1 |
| | 51-100 | 0 | 1 |
| | 101-250 | 0 | 2 |
| | 251-500 | 0 | 2 |
| | 501-750 | 1 | 3 |
| | 751-1000 | 2 | 5 |
| | Over 1000 | 1 | 7 |
| SPECIAL CLASSES TO ACCELERATE CAPABLE PUPILS | 50 or less | 2 | 9 |
| | 51-100 | 1 | 7 |
| | 101-250 | 2 | 9 |
| | 251-500 | 1 | 8 |
| | 501-750 | 1 | 7 |
| | 751-1000 | 2 | 12 |
| | Over 1000 | 2 | 9 |
| OPPORTUNITY CLASSES FOR GIFTED PUPILS | 50 or less | 0 | 2 |
| | 51-100 | 0 | 1 |
| | 101-250 | 1 | 3 |
| | 251-500 | 0 | 3 |
| | 501-750 | 1 | 5 |
| | 751-1000 | 2 | 11 |
| | Over 1000 | 4 | 14 |

**Fig. 50.**—Graph Showing the Percentage Frequencies of *Use,* and of *Use with Unusual Success,* of Special Classes, Primarily for the Very Slow or Very Capable in Schools of Different Total Enrollments. Reproduced by permission of the publisher from Billett, Roy O., "Provisions for Individual Differences, Marking, and Promotion," *National Survey of Secondary Education Monograph No. 13,* Bulletin No. 17, Washington, D. C., United States Government Printing Office, 1933.)

classes; in the smaller high schools, and when the type of help called for is rather unusual, it is individual or tutorial in character. For the handicapped child, vocational work is sometimes provided. In most cases, drill is emphasized. Minimum essentials are all that are required in the course. For the bright child, as already indicated, no correspondingly good devices have been formulated. The most common method is to permit such a child to carry more work.

Another teaching device that may be utilized to provide for individual differences is *supervised study.* Supervised study, as it is now generally understood, first came into prominence about 1898 at Batavia, New York, and has often been designated the Batavia plan. It gained wide popularity and has had many ardent advocates. Hall-Quest[29] has probably done more to popularize this method than anyone else. The method takes many forms, varying all the way from a study period with a teacher as monitor to almost completely individualized supervised study. Two causes have led to its wide use: poor study habits and poor working conditions in the home, making homework unfeasible; and the need of pupils for extra help from the teachers. Although there is not necessarily any relation between supervised study and the problem of individual differences, it is very likely that such a relation does exist. If all pupils receive the same treatment, then supervised study does not provide for differences. If, however, supervised study is used in the most intelligent fashion, the teacher in charge has an excellent opportunity to provide for the individual interests and needs of her pupils. The usual procedure is to devote one or more periods, often a double period, to study. The teacher may help pupils in the preparation of any of their lesson assignments. This help may consist in enforced study or in actual direction and help by the teacher. It is very evident, therefore, that supervised study has excellent possibilities, provided it is administered by a well-trained teacher.

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[29] Hall-Quest, H. L., *Supervised Study,* New York, Macmillan, 1916.

The methods of the progressive education movement described in an earlier section of this chapter[30] have been applied to high schools as well as to elementary schools. Thirty large high schools in the United States are making an experiment in progressive education. They have set up a program and are comparing their results with those of the more traditional high schools. Some idea of the nature of one kind of progressive education program can be gained from a description of the plan as it is being carried out in one section of the Evanston Township High School. About 140 pupils selected as representative of the high-school population are enrolled in this group. The program is divided into two parts. One part consists of the "core" curriculum. In the year 1937–1938, the general topic of study in this curriculum program was community living. The group was divided into smaller sections of from twenty-five to thirty pupils each. One of these smaller groups chose to study housing, devoting two or three ordinary class periods per day to this topic. The pupils first made a thorough survey of the housing conditions in the city and then made reports of their studies, discussing these with the teacher and other pupils. Such a study not only gave information about housing but led to a discussion of possible improvements in housing conditions. The study of housing conditions, in turn, led to a study of the cultural aspects of housing. One pupil who had visited in New England made a report on housing there, as contrasted with Evanston. Another pupil had lived in Oregon; this formed a basis for the study of housing in that state. By such methods, a wide survey of the interests and information of the children was tied up with an important problem in the life of the local community as well as other communities. The second part of the school program, which occupied about half of the school day, was given over to other types of interests. Some of those selected for freshmen were: mathematics for personal use, laboratory practice in English usage, science, art, music, German, and journalism. More special interests were to be developed in the remaining three years of high school. Some of these interests will no doubt be such that the children will be prepared for the usual college courses; many others will center around community problems, coöperative living, political issues, character building, and hygiene.

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[30] For a more complete statement of the methods of the progressive education movement, see Hopkins, L. T., *et al., Integration, Its Meaning and Application,* New York, Appleton-Century, 1937, especially Chs. IX–XIII; Melvin, A. G., *The Technique of Progressive Teaching,* New York, Day, 1932; National Society for the Study of Education, *Thirty-Third Yearbook,* Bloomington, Illinois, Public School Publishing Company, 1934; and Everett, Samuel, *et al., The Community School,* New York, Appleton-Century, 1938.

As with any other new movement, there are those who are most enthusiastic in praise of this method of instruction. Others are naturally skeptical. Undoubtedly, this emphasis on the child's interests, although not a new idea, has never before been so extensively utilized. The individualization of instruction, as far as it is feasible in the ordinary classroom, is a move in the right direction. It is inevitable that, in such a change as this movement in its extreme form constitutes, some of the values of the traditional school will be lost. There is certainly a place for systematizing a pupil's information in such subjects as English, mathematics, and chemistry. While drill has been overemphasized in the traditional school, it continues to be needed in the educational process. The progressive education movement, like many other similar movements, will probably make its contribution to educational practice and, in so doing, gradually eliminate some of the less successful methods. Meanwhile, the better traditional schools will see some of the advantages of the new movement and will gradually adopt them. As these better methods are adopted, they will cease to be considered new or radical and will become a part of the main body of educational practice.

As a method of providing for differences between pupils, *pupil guidance* is a combination of administrative provisions, curricular provisions, and methods. It may also comprise material and techniques which are not included under any of these headings. The term *guidance* is variously used, sometimes to include almost everything in the field of education and sometimes in the very narrow sense of extraeducational help. Furthermore, there are various kinds of guidance, the more common forms being curricular, vocational, and educational guidance. *Curricular guidance* generally means helping pupils in the selection of courses in school. *Vocational guidance* means giving help in selecting an occupation. *Educational guidance* may be synonymous with curricular guidance but more often it has the broader meaning of giving help in general school adjustment as a means of preparing for life after school. In addition to the above, there are other kinds of guidance, such as social, moral, and emotional guidance.

Guidance implies a freedom of choice on the part of the pupil. For example, there is really no problem of curricular guidance where there is only one program of study. This is one reason why there is so little guidance provided in the traditional elementary school. Guidance means the giving of advice to those who have need for help in *selecting* a school program and in *adjusting* to the school situation. Of course, such adjustment is generally to be considered in terms of the future as well as the present. This is true whether the future is considered from the point of view of a vocation or more broadly in terms of the whole of life. Guidance is rendered by various groups of people. Rosecrance has made a study of guidance in large elementary schools, junior high schools, and senior high schools.[31] Special guidance functionnaires were found on the staffs of about one third of the sixty-two elementary schools studied. In the fifty-two junior high schools (median enrollment 1,312) studied, there were 188 professional guidance workers and fifty principals. Four fifths of these schools had teachers especially assigned to guidance, with a ratio of 1,375 pupils per full-time counselor. The sixty-two senior high schools studied had a system of student personnel service, described below:

> *Student personnel service in senior high school.* The sixty-two senior high schools studied were three and four year high schools (median enrollment 2,396). An amount of time equivalent on the average to that of 1.75 full-time guidance workers per school was usually provided. Less help was received from outside specialists and agencies than in the elementary schools and junior high schools mentioned above. Class-room teachers assisted as home-room advisers. A cumulative record system, group intelligence tests, and homogeneous grouping were used in half or more of the senior high schools as other important resources in the personnel program. The pre-admission guidance program in these senior high

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[31] Rosecrance, F. C., *Organization and Administration of Personnel and Guidance Services in Large City School Systems,* Vol. IV, summary of doctoral dissertations, Evanston, Illinois, Northwestern University, 1936, pp. 40–41.

> schools was practically identical in character with the service provided for junior high school graduates. After entrance, students were usually assigned an adviser and participated in a program of orientation. Although annual physical examinations and guidance interviews were not generally provided, individual counsel was given to transferred, failing, and socially maladjusted pupils. Interviews were given in many schools when electives were chosen and at least once during the high school period each student's plans for college and choice of occupation were considered with him.
>
> Information concerning subject offerings, extra-curriculas, and occupations was provided through group and class-room discussions, distribution of pamphlet material, trips to industries and places of business. "Drop-outs" as well as graduates were usually interviewed, the former sometimes being aided in various ways to remain in school and the latter being advised with respect to their plans for the future.
>
> Professional guidance workers in the senior high schools were slightly better trained than those in the junior high school, but fifty-four per cent of such functionnaires had no experience outside of teaching. For prospective counselors various types of preparation were recommended: experience in teaching; work in factory, office or store; and courses in guidance, psychology, mental hygiene, social case work, and tests and measurements.

Some kind of guidance is provided in almost every school, from the elementary grades through the university; but the most extensive guidance is provided in senior high schools, with somewhat less in junior high schools and colleges. Regular guidance programs are much more common in large than in small high schools and colleges. Table LVII gives the number and percentage of colleges of a given size reporting personnel service.[32]

Successful guidance depends upon a good counselor who is provided with all possible pertinent facts about the person being guided, the school system in which training is given, and the world in which the pupil is to live after graduation. It is not easy to say who will make a good counselor. A few of the more important attributes necessary are intelligence or good common sense, a sympathetic

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[32] Strang, Ruth, *Personnel Development and Guidance in Colleges and Secondary Schools,* New York, Harpers, 1937, p. 33.

TABLE LVII

NUMBER AND PERCENTAGE OF COLLEGES REPORTING PERSONNEL SERVICE

| *Enrollment of College* | *Number of Colleges* | *Colleges Reporting Personnel Service* | |
|---|---|---|---|
| | | *Number* | *Per cent* |
| Over 15,000 | 5 | 5 | 100 |
| 10,000–15,000 | 9 | 7 | 78 |
| 5,000–10,000 | 22 | 11 | 50 |
| 1,000– 5,000 | 128 | 35 | 27 |
| 0– 1,000 | 399 | 27 | 7 |
| Total............. | 563 | 85 | 15 |

kindly attitude, a knowledge of human nature, and a knowledge of the facts necessary for giving good advice. Information about the pupils may be obtained by interviews, personal acquaintance, and school records. Except in a small school system where there is intimate contact between counselor and pupil, personal record cards are essential to successful guidance.

For obtaining information about the school, its opportunities, and vocational information, Koos and Kefauver[33] mention several methods. Most large schools and many of the smaller ones have printed handbooks which give courses of study and other pertinent facts about the curriculum. Student handbooks add to this information by describing extracurricular activities, rules of conduct, and so forth. Such information is valuable, but is generally not extensively used by the pupil, unless someone assists in interpreting these facts for him. Scholarship records should always be available as an aid in guidance. Such records should include, not only those from the school in which the pupil is now in attendance, but also those from all other schools which he has attended. It is unfortunate that there is not in general use some uniform permanent record, such as the army service record, which could follow the pupil throughout his school life and become a basis for placement after graduation. Many school systems give mental tests and standardized educational tests. These may provide valuable information for guidance. Richardson[34] has shown that, by means of a "General Ability Index," scholastic success can be predicted in many school subjects. This index is an unweighted percentile average of: (1) the Terman Group Test of Mental Ability; (2) the Nelson Silent Reading Test; (3) the New Stanford Achievement Test; and (4) the Nelson High School English Test. The index correlates with school grades as follows:

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[33] Koos, L. V., and Kefauver, G. N., *Guidance in Secondary Schools,* New York, Macmillan, 1934.

| | |
|---|---|
| English history | .59 |
| Algebra | .58 |
| English | .57 |
| General science | .53 |
| Home economics | .53 |
| Social studies | .53 |
| Latin: | |
| I | .43 |
| II | .55 |
| Geometry | .47 |
| Biology | .45 |

Predictive values were lower in mathematics, modern language, and business training ($r = .30$ to .40), and negligible in shop and mechanical drawing ($r = .15$ to 25). Not only can such information be used to advantage in curricular guidance, but it can be utilized in vocational guidance as well. For example, a pupil with an I.Q. below 100 should be discouraged from attempting medicine or law as a profession. There is also the equally important task of encouraging pupils with unusual intelligence to select occupations commensurate with their ability, not to mention the various special aptitudes[35] and interests that should be developed. Some of these can be measured but as yet many of them cannot be measured. There are several ways in which guidance can be accomplished in groups. One of these, which is of value in curricular guidance, is through general or survey courses. Such courses have been established in mathematics, English, general science, and general social science. Through these courses, the pupil is acquainted with the various fields of knowledge. He may then choose the one or ones in which he desires to specialize. Another kind of guidance which can be given to pupils is in connection with the selection of a college. Much printed matter is available on this topic, but a wise choice depends upon a careful study of many factors, such as a pupil's preparation, ability, interests, health, and finances. Many schools give courses about occupations.[36] Such courses usually tell about the requirements for the occupation, kinds of training required, nature of the work, and opportunities for placement. Either in connection with these courses or as another method of accomplishing a similar end, lectures are introduced representing the different occupations and professions in the community, and visits are made to different industries.

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[34] Richardson, H. D., *Ability Measures as Aids in Curriculum Guidance,* unpublished Ph.D. thesis, Northwestern University Library, 1937.

Difficult as vocational and curricular guidance are, there are problems of social, moral, and emotional adjustments that present even greater difficulties. One of the borderline problems is giving advice to pupils who are failing. School failures are due to many causes. The analysis of courses and the overcoming of difficulties often tax the ingenuity of the best counselors. Social maladjustments cause other guidance problems. The pupil who is excluded from social contacts because of economic, race, or personality factors presents other difficulties for the counselor. But the worst problem of all is that of the emotionally maladjusted pupil. This type of pupil generally represents the more advanced stage of some other maladjustment. Since it is an advanced stage of maladjustment and since the real causes are often deeply hidden, the counselor must probe deeply and carefully. After the causes are located, an even more difficult task remains in correcting the situation. As mentioned in Chapter X, there are five varieties of adjusting behavior, according to Schaffer.[37] Morgan[38] mentions no less than fifteen forms of maladjustments, as follows: (1) defense mechanisms; (2) distraction devices; (3) memory distortions; (4) daydreaming; (5) fears; (6) feelings of insecurity; (7) blaming others; (8) backbiting and reforming others; (9) compensation; (10) arguing and making excuses; (11) living in the past; (12) social maladjustments; (13) instability; (14) intellectual defects; and (15) delinquency. In addition to a careful description of these types of maladjustments, Morgan also gives many practical suggestions to aid the teacher and counselor in helping the pupil overcome these disorders.

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[35] Hull, Clark L., *Aptitude Testing,* New York, World Book Co., 1928.

[36] Jones, Arthur J., *Principles of Guidance,* second edition, New York, McGraw-Hill, 1934, Ch. VIII. Also Williamson, E. G., *Students and Occupations,* New York, Holt, 1937; and Bennett, Wilma, *Occupational and Vocational Guidance: A Source List of Pamphlet Material,* revised edition, New York, Wilson, 1936.

(3) *Provisions for individual differences in colleges and universities.* Although there are many methods for pro-

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[37] Schaffer, L. F., *The Psychology of Adjustment,* Boston, Houghton Mifflin, 1936. Chs. VI–X.

[38] Morgan, J. J. B., *The Psychology of the Unadjusted School Child,* revised edition, New York, Macmillan, 1936.

viding for individual differences in colleges and universities, only three are widely used, namely: variations in institutions or curricula; variations in the amount of work carried; and independent study or honors work.

Institutions of higher learning may be classified roughly into *liberal arts* (or *arts and sciences*) *colleges* and *technical* or *professional schools.* The last two terms are more or less synonymous, although institutes and technical schools generally refer to various kinds of engineering, while schools in medicine, law, commerce, and education are spoken of as professional. There might well be another group called the *fine arts;* this would include music, speech, painting, and sculpture. These different kinds of schools and the varying courses within the schools provide for individual differences in abilities and interests. A young man may have no interest in French in a liberal arts college. On the other hand, in studying business, he may find much interest in accounting. He may even become interested in French if he finds that the business in which he is specializing has large French connections. There is no attempt here to try to justify one or the other type of education; the point to be made is that there are many variations and differences between the different kinds of schools, just as there are great differences between the courses in any school. These differences provide opportunities for a person to select the type of school and course in which he can take the kind of work he desires.

It is probably unnecessary to say that the type of ability demanded by different colleges of liberal arts also varies. The extensive use of intelligence tests has shown how great the differences in ability of different college groups are. This fact is well illustrated by Table

LVIII,[39] which gives the median scores on the 1934 edition of the American Council of Education Intelligence Test for the first twenty-five colleges, listed alphabetically. The lowest median listed in this group, 107.69, is equivalent to a 12-percentile standing when compared with the total distribution of 52,435 students upon whom scores were reported. The highest median score listed in this group, 222.5, is equivalent to a 77-

TABLE LVIII

MEDIAN INTELLIGENCE TEST SCORES FOR TWENTY-FIVE COLLEGES

| *College* | *Median Intelligence Test Score* |
|---|---|
| Alabama College | 106.56 |
| Alabama Polytechnic Institute | 132.93 |
| Alabama State Teachers College | 107.69 |
| Alaska College | 163.75 |
| Alberta, University of | 220.00 |
| Albion College | 140.00 |
| Alfred University | 190.36 |
| Allegheny College | 180.71 |
| Antioch College | 224.55 |
| Arizona State Teachers College | 140.34 |
| Arizona State Agricultural and Mechanical College | 112.50 |
| Arkansas State College | 137.86 |
| Aurora College | 150.00 |
| Bakersfield Junior College | 163.18 |
| Baker University | 160.00 |
| Ball State Teachers College | 152.41 |
| Baltimore College of Commerce | 155.00 |
| Bay City Junior College | 176.87 |
| Bethany College | 177.92 |
| Birmingham-Southern College | 167.06 |
| Bishop's University | 200.00 |
| Blackburn College | 182.00 |
| Bowdoin College | 222.50 |
| Bradley Polytechnic Institute | 176.05 |
| Briarcliff Junior College | 172.50 |

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[39] Thurstone, L. L., and Thurstone, Thelma Gwinn, "The 1934 Psychological Examination," *Educational Record,* Vol. XVI (April 1935), pp. 226–240.

percentile standing when compared with the total distribution. The extreme differences in the abilities of college students, and the difference between the *average* quality of students in different colleges and universities, is clearly brought out in this table. It should no doubt be mentioned in passing that the faculties and equipment of the different institutions vary as much as do the student bodies.

Another provision for individual differences in ability is provided by *variation in student load.* The usual load is about fifteen hours per semester, or three majors under the quarter plan. At this rate, 120 hours, or 36 majors, will be completed in four years. However, a student may take as much as 20 hours or even more in some colleges. If the student carried such a load for three years, he would have completed enough credit for graduation. Of course, a student may also take less than the regular load. Although many colleges provide certain limitations, most provide for those who cannot or do not care to carry a regular program.

A relatively recent method for providing for individual differences is by *honors courses* or *independent study.* While these may not mean the same thing in all cases, the idea in both is to provide a method for the good student to take work outside or in addition to his regular classroom courses. Honor courses may refer to the type of subject matter, to the method of the course, or to both. At Harvard, where this method is used exclusively in the undergraduate college, it refers to a tutorial system of instruction in all subjects. In other colleges, certain students are allowed to study special topics, generally under the supervision of some member of the faculty. In some cases, regular meetings are held between student and instructor; in others, there is no set rule about such conferences. In a study concerning honors work in the 227 universities accredited by the Association of American Universities,[40] 103 (35.8 per cent) reported some form of honors work. Tables LIX and LX give the number of students taking honors work and the maximum amount of such work permitted a student per week in institutions of different sizes.[41]

TABLE LIX

NUMBER OF STUDENTS TAKING HONORS WORK IN COLLEGES OF DIFFERENT SIZES

| *Number of Students Taking Honors* | *Size of Student Body* | | | |
|---|---|---|---|---|
| | *500 or less* | *500–1,500* | *About 1,500* | *Total* |
| 1–20 ....... | 6 | 14 | 11 | 31 |
| 21–40 ....... | 2 | 3 | 7 | 12 |
| 41–60 ....... | 0 | 0 | 2 | 2 |
| 61–80 ....... | 0 | 1 | 2 | 3 |
| 81 or over... | 0 | 2 | 4 | 6 |
| No data .... | 3 | 16 | 8 | 27 |
| Total ..... | 11 | 36 | 34 | 81 |

TABLE LX

MAXIMUM NUMBER OF HOURS OF HONORS WORK PERMITTED EACH STUDENT PER WEEK IN COLLEGES OF DIFFERENT SIZES

| *Maximum Hours of Honors per Week* | *Size of Student Body* | | | |
|---|---|---|---|---|
| | *500 or less* | *500–1,500* | *About 1,500* | *Total* |
| 1–10 ....... | 3 | 7 | 6 | 16 |
| 11–20 ....... | 1 | 10 | 10 | 21 |
| 21–30 ....... | 2 | 0 | 2 | 4 |
| 31–40 ....... | 1 | 2 | 1 | 4 |
| 41–50 ....... | 1 | 2 | 0 | 3 |
| 51–60 ....... | 2 | 6 | 13 | 21 |
| No limit .... | 1 | 9 | 2 | 12 |
| Total ..... | 11 | 36 | 34 | 81 |

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[40] Sinclair, J. H., and Taylor, M. B., "Honors Work in Institutions Accredited by the Association of American Universities," *School and Society,* Vol. XXXIII (1931), pp. 247–250.

[41] Not all the institutions giving honors work are included.

Fifteen per cent of all the institutions studied do not permit the student to take more than from three to six hours in honors work; twenty-five per cent permit not over one sixth of the work in honors courses; and thirty per cent offer a complete program in honors for the upper division. Most institutions make no special provision for honors work in additional faculty. It is generally members of the teaching staff who carry the extra load, except in Harvard, Swarthmore, and a few other institutions, where most or all students read for honors. In most other institutions, only students with an A or not less than a B record are permitted to study for honors. From the foregoing discussion and data, it is apparent that honors work is given in institutions of all sizes but more in the larger universities. In most cases, less than fifty students are pursuing honors work in any institution. Students in most universities are permitted to take less than half their work in honors. It is probable that the American Association of Universities is not a fair example and that more honors work is given in these institutions than in the average college or university. Furthermore, it is impossible to predict the future of honors work. Nevertheless, it does seem that some plan of caring for the bright students will be generally recognized and adopted.

It remains to be seen whether or not some form of help for students who have difficulty in college work, such as that used and described by Mrs. Pressey[42] at Ohio State University, will become a regular practice. Mrs. Pressey divided a group which was failing into two groups. Using one of these as a control group, she interviewed the other and made a careful study to determine, wherever possible, the causes of failure within that group. Remedial methods were used with this latter group, with the result that many of those who would otherwise have failed were salvaged. Mrs. Pressey found, as might have been expected, that the remedial work had the greatest influence upon the brightest pupils. The lowest quarter of the group profited least by her help.

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[42] Pressey, Luella Cole, *Some College Students and Their Problems,* Columbus, Ohio, Ohio State University Press, 1929.

Most of the preceding discussion of *student guidance* applied to the high school, but there are also many examples of guidance and personnel work to be found in colleges and universities.[43] In fact, practically all higher institutions have some form of guidance or, as it is more often called, personnel program. In private institutions, a large part of the personnel procedure may consist in setting up an administering machinery and methods of selecting students. Another type of personnel work consists in giving advice to students in their selection of courses and programs of study. Most colleges also make attempts to help students secure employment after graduation. Other types of guidance or personnel work are to be found in colleges but, as a rule, only in the larger institutions is there any organized plan for its administration.

## Summary

Many advances have been made in the present century in methods for providing for individual differences in schools of all kinds. Great as they have been, a still greater utilization of these facilities will no doubt be made in the future. We need to know how to select and place people so that they will get the greatest good out of the educational facilities now available. This is a difficult problem, but one that holds out a great hope for the future. We have already made some important beginnings in this field, but so great are the possibilities for the future, that we may hope that the next generation will look back upon the present one as pioneers in educational and social guidance.

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[43] Strang, Ruth, *op. cit.* Also Williamson, E. G. G., and Darley, J. G., *Student Personnel Work,* New York, McGraw-Hill, 1937.

### Exercises

1. What are the chief causes of differences in the rate of learning: (*a*) within the same individual; and (*b*) between different individuals?

2. Cite facts illustrating differences in ability to learn which may exist: (*a*) within one individual; and (*b*) between a pair of individuals.

3. Rank in the order of their importance for learning French the following variables: (*a*) age; (*b*) innate ability; (*c*) interest; (*d*) method of instruction; and (*e*) available leisure.

4. How much change in rate of learning did Thorndike find from age twenty to forty-five? How is this amount influenced by the kind of material that is learned?

5. Starch found that in a history test the ratio of poorest to best was 1:26, while in an arithmetic test for division the ratio was 1:8. What are possible explanations of this difference in ratios? Are we to assume that children resemble each other more in the knowledge of division than in that of history?

6. Distinguish between maturation and learning, and comment upon the dependence of each upon environment.

7. Is there more difference in mental age or in chronological age in the typical first-grade class?

8. What are some important provisions for individual differences in the elementary schools?

9. Would you expect to find the same amount of difference in learning ability in elementary-school classes as compared with high-school and college classes? Give reasons for your answers.

10. Why is the ratio of lowest to highest so often missing from Table LII? To what extent can you accept as valid the ratios

which are given? What argument can be presented that the ratios are generally too high? How does the possible use of arbitrary zero in these tests affect the ratios obtained?

11. What provisions for individual differences are used in elementary schools that are not used in high schools? What new provisions are introduced in the latter?

12. Comment upon the progressive movement in education and point out the provisions it has made for individual differences.

13. What are some difficulties that would be encountered in trying to measure the value of various provisions for individual differences in schools?

14. What are some of the important facts about differences which the vocational counselor needs to know in order that he may render the wisest advice regarding the selection of a vocation?

15. Why is the averaging of percentiles, as done by Richardson in computing his "General Ability Index," not ideal statistical procedure? How does the magnitude of each percentile, from the fiftieth toward the extremes, change in value? Compare the average standing of persons who made percentile scores of 98 and 38 with those who made scores of 60 and 80. Why does an average of the latter two scores represent less ability?

16. What are some of the provisions for individual differences made in colleges and universities?

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## CHAPTER XII

# Applications of Individual Differences in Business and Industry

Nowhere are the facts of individual differences more applicable than in the fields of modern business and industry. This was always true, but never so true as at the present time. Before the time of the industrial revolution, when industry was largely conducted in the home, differences were not so significant. Even then, however, differences in strength and skill were no small factors in success or failure. But as steam power and electric power have gradually supplanted man power, the ability to use these as servants and the ability to organize men and resources has become dominant.

With this change in the source of power, there was, at first, a tendency to look upon man as a part of the machine unit. He was considered impersonally as a part of the manufacturing and distribution processes, and selected or rejected in the same way as materials or other impersonal factors in industry. While this tendency has by no means disappeared, in more recent times there has been a gradual shift in emphasis. Now there is a growing tendency to look upon the machine as an extension of man's powers. With this shift in emphasis, there has come about a greater interest in the selection and training of employees. This change has aroused much more interest than formerly in the educational, emotional, and social elements in industry.

The new attitude has increased the emphasis upon individual differences in industry. We are now especially concerned with the determination of the capacities, abilities, and interests of the workers. At least to a limited extent, this is true for all workers, and it is particularly important in skilled labor and in all classes of managerial and executive work.

Just as important as the analysis of the individual is the analysis of the job. As Scott and Clothier[1] pointed out so clearly several years ago, the only logical approach to efficiency is one in which we consider the *worker in his work*. This worker-in-his-work unit is composed of the *capacity* and *interest* of the worker and his *opportunity* for employment. Job analysis is a relatively modern concept, yet real progress in scientific management is dependent upon it and no successful solution of our business problems can be accomplished without it. Like the laborious scientific research in medicine and the other sciences, it is the *sine qua non* of true progress in business practices.

Two other major topics concern us in this chapter. One consists of a set of conditions which, when properly controlled, makes for greater efficiency in industry. Some of these conditions logically grow out of the first two topics mentioned. They consist in such things as the efficient selection and promotion of workers, the measurement of efficiency, hours of work, and wages.

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[1] Scott, W. D., and Clothier, Robert C., *Personnel Management*, New York, McGraw-Hill, 1923.

The other consists in factors which should, as far as possible, be eliminated from industry, in order to make for greater efficiency. Some examples of these factors are fatigue, monotony, fears, sickness, and accidents.

### Analysis of the Worker

Four things determine a man's fitness for any job: (1) his physical capacity; (2) his mental ability; (3) his education; and (4) his personality. As here used, these terms have a common-sense, rather than a technical, connotation; nevertheless, this usage does no serious violence to any scientific concepts. These four elements are not easily separable, and sometimes one predominates in importance and sometimes another.

**Physical capacity.** Despite all our labor-saving devices, physical strength is still a large factor in industry. Approximately seventy per cent of the people gainfully employed in this country earn their daily bread by the sweat of their brow. Part of this labor takes the form of lifting and carrying. Household movers, bricklayers, and masons do work of this kind. Other types of work combine strength and skill. Examples of this type of worker are lumbermen, carpenters, and farm laborers. In still other types of work, although some strength is necessary, skill is the larger factor. This class includes lathe operators, chauffeurs, typists, and musicians. Much of this latter kind of work requires, not only skill, but considerable endurance as well. The lathe operator has to stand or sit at his table or bench for eight hours a day for five or six days a week; the typist also expends a good many foot-pounds of energy during a day's work. The person who is considering a lifework must face the problem of his capacity in strength and skill. The small man may make good as a day laborer or as a football player, but he does so at a tremendous handicap. With sufficient practice, most men and women can learn to play a piano. But in these days of so much competition in this field only the exceptionally skillful person can hope to make a living in this manner.

Health is still another element in success. There is a rather high correlation between health and efficiency. For this reason the person who is often sick is likely to be the first to be dismissed in times of stress. Many large industrial organizations protect themselves as best they can from the physically handicapped and the unfit by careful physical examinations of all candidates for positions. This is especially important now that so many states have compulsory workmen's compensation laws. It has also been found that, as a class, the sick and the handicapped are most prone to accidents. Therefore a company is justified in many ways by not hiring the unfit.

**Mental ability.** Important as physical capacity is in industry, mental ability is even more so, at least in all the higher types of work. The typical day laborer may not need a high degree of intelligence. In fact, if his work is routine, much mental capacity may be a handicap. But the emphasis on the disadvantages of mental ability may be easily overdone; intelligence may prove an asset even in the performance of menial tasks. Who has not had the experience of lamenting the employment of a gardener, a repairman, or a maid who was unable to understand or follow simple directions? However this may be in the simpler types of occupations, intelligence is certainly an asset in all forms of semiskilled and skilled labor and in all kinds of management.

In Chapter VIII, a graph was presented showing the range for the middle fifty per cent of scores on the Army

## TABLE LXI

### ARMY ALPHA SCORES FOR SEVERAL REPRESENTATIVE OCCUPATIONS SHOWING THE MEAN AND INTERQUARTILE RANGE

| *Occupation* | *First Quartile* | *Mean* | *Third Quartile* |
|---|---|---|---|
| Clergyman | 124 | 152 | 185 |
| Engineer | 110 | 161 | 183 |
| Physician | 107 | 127 | 164 |
| Accountant | 103 | 137 | 155 |
| Y. M. C. A. Secretary | 99 | 111 | 163 |
| Teacher | 97 | 122 | 148 |
| Chemist | 94 | 119 | 139 |
| Dentist | 80 | 110 | 128 |
| Nurse | 78 | 99 | 126 |
| Bookkeeper | 77 | 101 | 127 |
| Conductor (railroad) | 64 | 83 | 106 |
| Druggist | 61 | 78 | 106 |
| Clerk (postal) | 60 | 81 | 106 |
| Photographer | 59 | 86 | 107 |
| Musician (band) | 57 | 82 | 108 |
| Electrician | 57 | 81 | 109 |
| Engineer (locomotive) | 53 | 74 | 91 |
| Telephone operator | 46 | 70 | 95 |
| Policeman | 46 | 69 | 90 |
| Detective | 46 | 69 | 90 |
| Plumber | 45 | 66 | 88 |
| Automobile mechanic | 43 | 65 | 91 |
| Tailor | 42 | 65 | 89 |
| Caterer | 41 | 57 | 81 |
| Butcher | 40 | 61 | 85 |
| Baker | 40 | 59 | 87 |
| Farmer | 40 | 58 | 83 |
| Painter | 38 | 59 | 81 |
| Cobbler | 38 | 56 | 76 |
| Salesclerk | 38 | 52 | 96 |
| Bricklayer | 37 | 58 | 82 |
| Barber | 34 | 55 | 78 |
| Teamster | 30 | 50 | 72 |
| Mason | 19 | 40 | 60 |
| Lumberman | 18 | 35 | 62 |
| Cook | 17 | 27 | 57 |
| Sailor | 16 | 32 | 59 |
| Fisherman | 15 | 20 | 51 |
| Laborer | 13 | 21 | 47 |

Alpha test for many occupations. Several other such distributions[2] have been constructed, as in Table LXI. These studies provide the vocational counselor and the employment manager with information about how much intelligence is possessed by the average person in each of these occupations. This does not necessarily indicate the amount of intelligence that ought to be possessed. For example, a score of 127 on Army Alpha may not be as high an average as physicians should possess. It is the average of the group studied and, in so far as the subjects were typical, it represents the average of those now in that profession. The interquartile range is given in these studies on the assumption that this is the range within which the majority of successful individuals are found. Some individuals below the range may be successful, but anyone below the lower quartile should be considered or recommended for any occupation with at least some reservation or only on the basis of some compensating factors. In so far as the scores are true measures of intellectual ability and in so far as such ability is essential for success, those above the third quartile score should represent the leaders in the occupation. It should be kept in mind, however, that a readjustment may need to be made in occupational placement when the intelligence level is too high, as well as when it is too low for any occupation.

Thus far in this discussion, mental ability has been treated as a general capacity. We must also keep in mind the fact that men possess special abilities and disabilities. One of the great problems in industry is to discover what abilities are demanded in any kind of work and then to select workers who meet these requirements. A barber may not necessarily be required to possess a high degree of general intelligence, but he must have the ability to use sharp tools with a high degree of skill. There are great individual differences in the time required to develop skill and the limits of skill that can be acquired in this kind of work. The manager of a department store must possess ability to handle people as well as the ability to learn the needs and desires of his patrons. Much of his ability is the result of training, which will be discussed in another section of this chapter. Here we are emphasizing the fact that there are great differences in both the general and special abilities which are required in various kinds of work. These abilities must be recognized and training provided for the most successful utilization of man power in industry.

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[2] Fryer, Douglas, "Occupational Intelligence Standards," *School and Society,* Vol. XVI (1922), pp. 273–277. Also Pond, Millicent, "Occupations, Intelligence, Age, and Schooling," *Personnel Journal,* Vol. XI (1933), pp. 373–382.

**Aptitudes.** The word *aptitude* is used with many different meanings. It sometimes refers to the native capacity of any person in any field. For example, a person might be said to have an aptitude for the Japanese language, although he did not know a word of it. *Aptitude* is also used to indicate a person's present standing in any field of endeavor, irrespective of how he came to possess this ability. A boy of thirteen may have an aptitude for multiplying ordinary decimal fractions. This latter meaning is the one which will be adopted here. In so far as aptitudes can be tested, most tests[3] measure aptitude in this latter sense. There is no great difficulty in this procedure if it is realized that, in order to estimate future accomplishments, we know how much training has been necessary to produce the present accomplishment. If a girl can type forty words per minute, this is her present aptitude for typing. As has just been pointed out, if we wish to know how successful a typist she is likely to become with six months' experience, it is important to know whether she has completed a year's course in typing in high school, a two-months' secretarial course, or has had no formal training at all in this field.

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[3] Some tests, much more than others, attempt to measure native capacity. Intelligence tests have been thought by some to measure innate ability. Other tests have been devised to measure mechanical, mathematical, and language ability. These are called *prognostic tests,* to distinguish them from achievement or accomplishment tests. Needless to say, no test is completely prognostic. Some tests are more independent of specific training than others, but none are completely free from the influence of training.

Aptitudes may be broad or narrow. We may speak of tapping with the index finger of the right hand as an aptitude or we may consider the aptitude of a person for the presidency of the United States. People differ in the kinds of aptitudes they have and in the amount of aptitude they possess in any given field. For example, a person may possess a great deal of aptitude for driving an automobile or for geography, but not much for golf or English. This we may call differences in *kinds* of aptitude. A person may also differ from someone else in the *amount* of the aptitude he possesses. For example, children may differ in their amount of aptitude for history. Most comparisons of aptitude are of this second type. Any comparison or study of the amount of differences in ability depends upon some sort of measurement. Much study has been given to the subject of the measurement of differences in aptitude.[4] Because the word *apti-*

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[4] The studies of aptitudes and their testing has been well summarized in three different texts. The earlier work was reviewed in Hull, C. L., *Aptitude Testing,* Yonkers, New York, World Book Company, 1928. Later tests are described in Bingham, W. V., *Aptitudes and Aptitude Testing,* New York, Harpers, 1937; and Paterson, D. G., Schneider, G. G., and Williamson, E. G., *Student Guidance Techniques,* New York, McGraw-Hill, 1938.

*tude* is defined in so many different ways, many of the studies already reported might be considered as differences in aptitudes. For example, differences in intelligence might be looked upon as differences in aptitude. As the word is here used, the discussion will be limited to aptitudes in five fields.

(1) *Aptitudes in unskilled labor.* This topic has already been mentioned and little need be added here. One reason for limiting this discussion is that tests have not generally proved successful in measuring these kinds of differences. Some attempts have been made to use the dynamometer for strength tests, but these have not proved very valid measures of aptitude. The most satisfactory measure of aptitude in unskilled manual tasks is work output. If we are interested only in how people differ in such a task as digging a ditch, any fair test of work output will give such differences.

(2) *Aptitudes in manual skills.* Considerable question has arisen as to whether there is any such thing as a general manual skill. Seashore[5] believes that mechanical skills, for example, are specific and that one type of mechanical skill is not necessarily related to other types. Nevertheless, many tests have been constructed for measuring different motor skills. Trade tests were constructed during the World War to measure aptitudes for many kinds of work. Sometimes these tests were pencil-and-paper tests; sometimes they were performance tests. Norms were determined by which soldiers were classified as either: (*a*) experts; (*b*) journeymen; (*c*) apprentices; or (*d*) novices. Trade tests have had only a limited usefulness in industry. Link[6] has described batteries of

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[5] Seashore, R. H., "The Aptitude Hypothesis in Motor Skills," *Journal of Experimental Psychology,* Vol. XIV (1931), pp. 555–561.

[6] Link, H. C., *Employment Psychology,* New York, Macmillan, 1919.

tests that were used to measure various abilities in the munitions industries during the War. Since that time, the number of tests of different skills has increased until they are now legion. No attempt can be made here to list them all. One of the most comprehensive and widely used of the more general tests, however, is the Minnesota Mechanical Assembly Test.[7] This consists of assembling sets of ten or more small articles—such as a mousetrap, a bicycle bell, and a monkey wrench—which are disassembled and the parts placed in compartments in a test box. A rather complicated method of grading, based upon both a time limit and the correctness of assembling the various objects, is used for scoring. Table LXII

TABLE LXII

STANDARD NORMS FOR BOYS ON THE MINNESOTA MECHANICAL ASSEMBLY TEST

| *Standard Score** | *Percentile Rank* | *Age* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *11* | *12* | *13* | *14* | *15* | *16* | *17* | *18* | *19* | *20* | *21+* |
| 7.50 | 99.4 | 314 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 | 329 |
| 7.00 | 97.7 | 305 | 316 | 316 | 316 | 322 | 324 | 321 | 327 | 327 | 327 | 326 |
| 6.50 | 93.3 | 291 | 296 | 295 | 298 | 311 | 315 | 309 | 321 | 321 | 324 | 321 |
| 6.00 | 84.1 | 270 | 281 | 281 | 282 | 295 | 305 | 298 | 314 | 314 | 319 | 312 |
| 5.50 | 69.1 | 251 | 257 | 271 | 272 | 278 | 293 | 288 | 302 | 310 | 311 | 303 |
| 5.00 | 50.0 | 231 | 232 | 252 | 257 | 260 | 276 | 273 | 287 | 299 | 299 | 289 |
| 4.50 | 30.9 | 211 | 209 | 225 | 234 | 242 | 255 | 254 | 274 | 285 | 284 | 267 |
| 4.00 | 15.9 | 184 | 189 | 199 | 211 | 221 | 222 | 232 | 256 | 259 | 262 | 238 |
| 3.50 | 6.7 | 160 | 168 | 177 | 186 | 190 | 192 | 207 | 231 | 219 | 241 | 208 |
| 3.00 | 2.3 | 152 | 156 | 160 | 164 | 148 | 147 | 183 | 200 | 199 | 230 | 173 |
| 2.50 | .6 | 149 | 149 | 149 | 149 | 119 | 119 | 164 | 179 | 189 | 224 | 149 |

* The formula for a standard score is $\frac{X-M}{\sigma}$, in which $X$ is the raw score, $M$ the mean of the distribution, and $\sigma$ the standard deviation of the distribution. In this and the following two tables, 5 has been added to each standard score in order to avoid the use of negative numbers.

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[7] Paterson, D. G., *et. al.*, *Minnesota Mechanical Ability Tests*, Minneapolis, University of Minnesota Press, 1930.

gives standard norms for boys from age eleven to twenty-one; Table LXIII, standard norms for adult men and women; and Table LXIV, sample occupational norms for adults.

TABLE LXIII

STANDARD NORMS FOR ADULTS ON THE MINNESOTA MECHANICAL ASSEMBLY TEST

| *Standard Score** | *Percentile Rank* | *Men* | *Women* |
|---|---|---|---|
| 8.00 | 99.86 | 329 | 308 |
| 7.50 | 99.4 | 323 | 302 |
| 7.00 | 97.7 | 318 | 289 |
| 6.50 | 93.3 | 311 | 270 |
| 6.00 | 84.1 | 302 | 257 |
| 5.50 | 69.1 | 293 | 240 |
| 5.00 | 50.0 | 281 | 225 |
| 4.50 | 30.9 | 262 | 208 |
| 4.00 | 15.9 | 245 | 193 |
| 3.50 | 6.7 | 224 | 178 |
| 3.00 | 2.3 | 201 | 148 |
| 2.50 | .6 | 177 | 126 |
| 2.00 | .14 | 171 | 114 |

* See note for Table LXII.

TABLE LXIV

SAMPLE OCCUPATIONAL NORMS FOR ADULTS ON THE MINNESOTA MECHANICAL ASSEMBLY TEST

| *Occupational Group* | *Average Standard Score** | *Raw Score* | *Percentile Score* |
|---|---|---|---|
| Machinists | 5.85 | 300 | 80 |
| Manual-training teachers | 5.49 | 293 | 68 |
| Ornamental ironworkers | 5.48 | 293 | 68 |
| Automobile mechanics | 5.42 | 290 | 66 |
| Skilled manual workers | 5.05 | 282 | 52 |
| Machine operators (lathe, drill, press, *etc.*) | 4.98 | 281 | 49 |

* See note for Table LXII.

The reliability of the test for the junior-high-school age is given as .94 and for men as about .80. A rather high validity is indicated by the relatively high scores for occupations where manual skills are important. Correspondingly low scores were obtained for such occupations as life-insurance salesmen (median percentile, 44) and casual laborers (median percentile, 18), where manual skills are not important. There are also many form-board tests for measuring more specific motor skills. One of the better known of these is the Finger Dexterity Test by O'Connor.[8] This test has a high reliability (over .90) and considerable predictive value for certain kinds of work.

(3) *Clerical aptitudes.* Clerical aptitudes, like the others we have studied, comprise, not one, but many different aptitudes. Clerical work ranges all the way from such things as running errands, copying on the typewriter, operating a comptometer, and filing to checking and supervising work of this kind. The work of the personal or private secretary is also generally classed as clerical, even though it may consist of substituting for the manager or president of the organization in the latter's absence. The aptitudes necessary for success in the clerical occupations are as great, and the differences in ability required as varied, as the duties themselves. For this reason, intelligence test scores have often been found to be as good a prognosis of success as any. O'Rourke[9] has constructed a test for stenographers and typists. The test has a validity of .70 when measured by correlating scores with efficiency ratings in two industries.

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[8] O'Connor, Johnson, *Born That Way,* Baltimore, Williams and Wilkins, 1928.

[9] O'Rourke, L. J., "Scientific Personnel Selection," *Occupations,* Vol. XII (1934), pp. 29–39.

(4) *Aptitudes in academic subjects.* Numerous standard tests have been constructed for the various school subjects in the elementary school, high school, and college. Many studies summarize the results of the use of such tests. Several tests are grouped in batteries. The New Stanford Achievement Test is for use with grade-school pupils; the Iowa Placement Tests—in such subjects as mathematics, chemistry, and foreign languages—are for use with high-school and first-year college students. Norms for all these tests indicate great differences in pupils. As pointed out in the preceding chapter, the average class above third or fourth grade contains pupils varying in ability in the different school subjects by at least four or five grades.

(5) *Aptitudes in executive work and the professions.* We do not know what differences in aptitudes make one person a successful railroad president or banker and another person a successful lawyer or doctor. No doubt, there are some things, such as intelligence, which members of the higher types of occupations have in common. Nevertheless, the fact remains that some men have the type of ability which makes them successful businessmen, while others who would not succeed at this kind of work become instead great leaders in research. There are no good measures of administrative or executive aptitudes. We do, however, have some aptitude tests for predicting success in the professions. Moss,[10] for example, has constructed a medical aptitude test which is used by practically all the better medical schools in the country as an aid in selecting students. There are six parts to the test, covering comprehension and retention, visual memory,

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[10] Moss, F. A., "The Secretary's Report," *Journal of the Association of American Medical Colleges,* Vols. XLI–XLVI (September 1931, May 1932, January 1933, March 1934, January 1935, and February 1936).

memory for content, logical reasoning, scientific vocabulary, and understanding of printed material. No reliability score has been obtained for the test. In one study, the test predicted fifty-three per cent of student failures and would have excluded only five per cent of high scholarship students. In some other studies, forty-three per cent of those in the upper tenth on the test were later rated as the best interns, while only five per cent of this group were rated average or poor. In another group of the ten per cent rating lowest in the tests, forty-three per cent had failed by the junior year.

Other professional aptitude tests have been constructed for law, nursing, and engineering. These tests have not yet been used extensively enough to determine their significance. Whether in college, professional schools, or in industry, test scores must always be used as supplementary aids, rather than as the sole criteria for the selection or rejection of candidates.

Before closing this discussion of aptitudes, two related problems remain for consideration, first, how widely aptitudes are distributed between people; and, second, how greatly aptitudes vary in any one individual. Hull,[11] summarizing studies by Starch and others, comes to the conclusion that "among individuals ordinarily regarded as normal in the average vocation, the most gifted will be between three and four times as capable as the poorest." Sometimes, of course, differences will be much greater than this. Aptitudes also vary greatly within an individual. Taken collectively, the aptitudes of any one individual seem to assume the form of a normal distribution. Differences in aptitudes within an individual Hull found to be about eighty per cent as great as differences between individuals on any one trait. That is, the average individual's best vocational possibility is from two and one half to three times as good as his worst. If differences are as great as this, the dangers of vocational maladjustment, as well as the possibilities of good placement, become very apparent.

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[11] Hull, *op. cit.*, pp. 36 and 48–49.

**Education.** Education is here used to represent two kinds of training. One kind refers to general school instruction and the other to specific training for a lifework. The importance of either or both types of educational training for any kind of work depends upon the skill required. The day laborer may be just as effective in his work with little or no formal educational training. Even the amount of specific training necessary may be given in a few minutes. From this extreme, we may pass to the preparation necessary to practice modern medicine. The medical practitioner who has completed his formal education has received sixteen years of general educational training, four years of specific instruction in medical school, and approximately two years of internship in some hospital. In addition to this, if he wishes to be a specialist in some branch of medicine—in psychiatry or pediatrics, for example—two or three more years of training are required.

The modern youth must consider the problem of his education very seriously. If he is to attain a position of responsibility and eminence, he must prepare himself for it. How shall this be done? Much has been written on the topic of vocational and educational guidance. However, the volume of the literature in this field is no indication of its worth. About the best we can do is to determine the ability of the person as accurately as possible, his personal characteristics, and his interests, and then to tell him what is required in the way of training in his chosen field, if he is fortunate enough to have a field or fields of interest. Such a method is a common-sense procedure rather than a scientific one, but this is about as far as we have gone as yet.

Possibly this is too discouraging a picture. There is no question but that we have made progress; we do know many things about how and what to teach and study. But much still remains to be found out. For example, which school subjects should be required and which made optional? How much and what kind of formal mathematics does the average businessman need? Should the social sciences be taught at the high-school level? These are only the general problems with which we are confronted. More specifically, what subjects should an engineer study? Should the prospective dentist be required to complete one, two, or four years of liberal arts work before beginning his professional course? Should professional students study such subjects as psychology and the social sciences at the expense of a high degree of specialization? These are all-important questions, and there are many who think they know the answers. Unfortunately, however, these answers are still opinions and, however weighty, they are not founded upon experimental evidence. Education is a problem of individual differences. The amount and substance of what is taught and learned makes people even more different than they naturally are. A man may have the natural capacity for an important position, but whether he is or is not prepared for it depends upon his education.

**Personality.** There is another factor in a person's make-up which, for the higher positions in life, is just as important as are health and education. Although, as pointed out in Chapter X, the term *personality* is used in many different senses, probably this is as good a word as any to refer to this factor or, more exactly, to this constellation of factors. Without any attempt at a complete analysis of personality, it may be assumed to be made up of such qualities as intelligence, personal appearance, sociability, aggressiveness, emotionality, and morality.

A man's success, for example, in selling life insurance is certainly just as much dependent upon certain personality factors as it is upon whether or not he is a college graduate. The lawyer and the minister likewise must possess certain traits in order to be successful. Each job has its own requirements in personality characteristics and each person his own characteristics. The task is simply one of getting the person with the proper personality into the right job. It should be pointed out here that the problem is not just a matter of selecting people with high standing in each trait. With the possible exception of intelligence and morality, a high degree of any trait is not in itself a virtue or even a qualification for any kind of job.

As has just been intimated, in order to meet the serious problem of placing the individual, it is necessary to determine his strengths and weaknesses in personality and then to select the kind of work for which he is qualified. How can this be accomplished? Many psychologists[12] have suggested that tests should be used for this purpose. Many firms have used intelligence tests with varied success. Often too much has been expected of these tests, however. It must be remembered that intelligence, although possibly the most important single factor, is only one trait in a person's make-up. A high degree of intelligence may be negated by a low or high degree of aggressiveness, or by some other trait or combination of traits.

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[12] Kingsbury, F. A., and Kornhauser, Arthur, *Psychological Tests in Industry*, Chicago, University of Chicago Press, 1926. Also Bingham, W. V., *Aptitudes and Aptitude Testing*, New York, Harpers, 1937.

**Interest as a factor in success.** There is no way by which we can make a direct comparison of the relative importance of ability and interest as factors in success, but it seems likely that people differ as much, if not more, in their interests as in their abilities. The range of human interests is practically unlimited. As has already been indicated, success in any line of work is as likely to depend upon an interest as it is upon an ability to do that kind of work. Not every man with the ability and with the training necessary to make a good lawyer will make one. A man must put his heart into his work in order to be successful, and he is not likely to do this if he is not interested in it. How to find a person's interests and how to direct them in the proper channels is one of the major problems of education, as well as of selection and promotion in industry. Herbart, in the early part of the nineteenth century, was the first to point out the significance of interest in the field of education. As a result of his emphasis, teachers began to attempt to make schoolwork interesting. But much has remained for modern workers to add to this concept. Under the headings of interest, purpose, and motives, many studies have been made and many articles and books written.

One of the subjects to receive early consideration was that of the permanency of interests. Is the child who wants to be an aviator or a doctor likely to persist in this interest? Thorndike[13] made a study of this problem. He had college juniors rank, in the order of their interest in these fields, the following school subjects: mathematics, history, literature, science, music, and various types of handiwork. These subjects were to be rated as the students remembered them as elementary-school interests, then as high-school interests, and finally as their present interests. Thorndike correlated these ratings of interest and found a correlation of over .60 between elementary-school and college interests. This, he believes, is evidence of the high degree of permanency of interests. Others have criticized the method used by Thorndike in this study, and several studies have justified the skepticism in so much permanency in interests. Fryer,[14] who has made a more extensive investigation of the problem, believes that there is a tendency for youthful interests to remain in the same specific field or in some closely related field. According to him, early interests are not as likely to indicate permanent likes and dislikes as are those developed at high-school or college age.

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[13] Thorndike, E. L., "The Permanence of Interests and Their Relation to Abilities," *Popular Science Monthly*, Vol. LXXXI (1912), pp. 449–456; and "Early Interests: Their Permanence and Relation to Abilities," *School and Society*, Vol. V (1917), pp. 178–179. See also, *The Psychology of Wants, Interests and Attitudes*, New York, Appleton-Century, 1935.

Another important problem is the relation of interest to ability. If a boy is interested in music and medicine, is this an indication that he has ability in these fields? Thorndike also studied this problem. He had the same students used in the preceding experiment rank their ability in these same subjects, and found a correlation of .66 between interests at ages eleven and fourteen and ability at age twenty-one or later. Thorndike believes interests are a good index of ability. Bridges and Dollinger,[15] however, have criticized Thorndike's method and, in an experiment of their own, compared students' ranking of interests in college subjects with the grades they later obtained in these same subjects. This study showed a correlation of about .25 between interest and ability. Other studies of this same type have given conflicting results. It seems probable that Thorndike's correlations are too high, owing largely to the halo effect carrying back in the memory of students. It is also probable that Bridges and Dollinger's correlations are too low because of the low reliability of both the ratings of the students and of the college grades. On the other hand, it is unsafe to infer much about the whole field of interests and abilities from a sampling of college courses. It seems reasonable, therefore, to assume that there is some relationship between ability and interest but that this relationship is not high. About all we can say is that a child's interests should be seriously considered. Unless there is good reason to believe that he cannot make good in his chosen field, he should be encouraged in it. A high degree of interest will motivate the individual to overcome even serious handicaps. There are many modern Demosthenes' who have made good despite physical obstacles. The writer well remembers a boy who had been chosen by an optical company to grind lenses, despite the fact that he had an incurable defect of the eyes, which caused them to move continuously instead of fixating upon any point. In spite of this severe handicap, the boy succeeded, after having been chosen from a group of applicants, the rest of whom had normal vision. On the other hand, it would be foolish to encourage a boy with an I.Q. of 85 to study law or medicine. Interest is by no means always an indication of ability.

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[14] Fryer, D., *The Measurement of Interests,* New York, Holt, 1931.

[15] Bridges, J. W., and Dollinger, W. M., "The Correlation Between Interests and Abilities in College Courses," *Psychological Review,* XXVII (1920), pp. 308–314.

Strong's Interest Blank was described in Chapter X. This measure of interests has considerable value in vocational guidance, though it has not had as wide usage as it deserves. For those professions and businesses for which norms have been developed, this blank has much value in determining whether the person has the interests of those who have been successful in the work. Strong[16] has recently shown that, over a period of several years, this test proves that interests are rather permanent and that the results of the tests have considerable predictive value. He found the average correlation between the scores of 223 college seniors for twenty-one occupational scales and the scores for these same people five years later to be .75. This not only indicates the reliability of the scales but also the permanency of interest, as measured by the scales. Several other interest scales are also available. Some have been constructed for high-school pupils and others for women.[17] Thurstone,[18] by means of factor analysis, grouped the interests of college students into seven major groups, as follows: descriptive interests, commercial interests, legal interests, athletic interests, academic interests, biological interests, and physical science interests. Since this test indicates only large occupational groupings, rather than specific occupational interests, it has not had as wide usage as the Strong scale.

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[16] Strong, E. K., *Changes of Interests with Age,* Stanford, California, Stanford University Press, 1931.

[17] Strong also has a form of his interest blank for use with women; this has scoring stencils for seventeen occupations. For another test for women, see Manson, G. E., "Occupational Interests and Personality Requirements of Women in Business and the Professions," *Michigan Business Studies,* Ann Arbor, University of Michigan, 1931. One of the best-known tests for high-school pupils is Garretson's and Symonds' interest questionnaire for high-school students. For a description of this test, see Garretson, O. K., *Relationships Between Expressed Preferences and Curricular Abilities of Ninth-Grade Boys,* New York, Columbia University, 1930; and Symonds, P. M., *Tests and Interest Questionnaires in the Guidance of High-School Boys,* New York, Columbia University, 1930.

[18] Thurstone, L. L., *Vocational Interest Test,* Chicago, University of Chicago Press, 1935.

One of the greatest problems in education and industry is that of motivation, or the arousal of interest. If college students really became interested in their college work, what a difference it would make! Teachers would be sought by eager students; they would not dare cut classes because of student protests. Library reading rooms would have to be enlarged to provide space for study. Athletics and college social life would have to be curtailed, because they would interfere with study. It is not to be inferred from this that college students are lazy but rather that their interests too often are other than that of educational and intellectual attainment. In like manner, what would be the result if employees should bend their full energy to the production, transportation, and sale of goods? What executive would not be startled to have his employees organize to determine how they could work more effectively? On the other hand, would not most employees be shocked if the management should suddenly begin a sincere attempt to provide the very best possible working conditions and the highest possible salary in a wholly altruistic spirit, without thought of its own gain? Not that such things do not occur, but they occur so infrequently. In fact, it is so unusual an occurrence that any "golden-rule" or "good-will" company which has the semblance of sincerity makes good newspaper reading material.

Many methods have been devised to try to stimulate employee interest. Some of the more common of these are: (1) profit-sharing; (2) piece-rate pay; (3) bonuses; (4) part employee ownership; (5) employee representation in management; (6) medical, social, and recreational facilities; (7) good selection and promotion plans; (8) good working conditions; and (9) shorter hours. These all have their value and, when rightly used, either singly or some combination of them, are likely to lead to success. There is no general formula that will predict what system will succeed. Whatever system produces the most sincere coöperative spirit of good will between employer and employee will prove to be the best.

## Job Analysis

The first beginnings in job analysis can be attributed to Frederick W. Taylor,[19] at about the beginning of the present century. Taylor, an engineer, began his investigations by studying best methods of work. At the Bethlehem Steel Company, he found that, working in the usual way, workers could load on the average about twelve and a half tons of pig iron per day. He selected a typical worker. The worker was told that, if he would follow directions, his pay would be increased from $1.15 to $1.85 per day. His instructions were to carry a piece of iron, deposit, and then rest a short time; carry—rest, carry—rest, and so on. By following these instructions, the worker was able to handle forty-seven and a half tons the first day—almost four times the usual amount. Other employees were selected who, by following directions, were able to complete a similar amount of work. As a result, the number of workers was reduced to almost one fourth the original number, with no loss in total output. Taylor also used time-study methods to determine the standard time for completing the different processes in industry. These studies served a double purpose, as a means of determining the most efficient method of work and as a basis for rate of pay.

Gilbreth[20] was also greatly interested in job analysis.

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[19] Taylor, F. W., *Principles of Scientific Management,* New York, Harpers, 1911.

[20] Gilbreth, F. B., *Motion Study,* New York, Van Nostrand, 1911.

He wished to determine "the one best way" of performing each task. Using a stop watch and motion-picture camera, he analyzed many types of work. By attaching a small light to the hands of a lathe worker, for example, he was able to photograph the movements the man made in his work. By comparing the novice with the expert, he was able to show the better ways in which to work. By analyzing the work of the expert, he was able to improve on the latter's technique. The best bricklayer, Gilbreth found, made an average of eighteen distinct movements in laying each brick. By analysis, he found that these movements could be reduced to about five. This, of course, resulted in a great increase in the number of bricks that could be laid in a day—an increase from an average of about 120 per hour to about 350 per hour.

Ordinarily the work of Taylor and Gilbreth has been called scientific management rather than job analysis. However, the methods used were essentially the same as for job analysis, and we are here considering them as the forerunners of the work in this latter field. The first real job analysis on a large scale was developed during the World War. In order to develop trade tests for the selection of technical men in the Army, it was necessary to make job analyses of the work before the tests could be constructed. Since that time, many industries have made job analyses, or occupational descriptions, as they are often called. These descriptions are placed in the hands of the employment managers to aid them in selecting men. Obviously, the more exact the description, the better able the employment manager is to select the right person for the job.

Viteles[21] has constructed a guide indicating the important facts that should be considered in making a job analysis. These are:

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[21] Viteles, M. S., *Industrial Psychology,* New York, Norton, 1932.

1. Identification of the job.
2. Number employed.
3. Statement of duties.
4. Machines used.
5. Analysis of operation.
6. Condition of work.
7. Pay and nonfinancial incentives.
8. Relation to other allied jobs.
9. Opportunities for transfer and promotion.
10. Time and nature of training.
11. Personnel requirements:
    - (*a*) Age, sex, marital status, etc.
    - (*b*) Physical.
    - (*c*) Educational.
    - (*d*) Previous experience.
    - (*e*) General and special abilities of temperamental and character requirements.

In actual practice, it is seldom that all these items are included; nevertheless, they should be considered. Figure 48 [22] gives a sample of an occupational description.

Job analysis is essential in securing the best "worker-in-his-work" organization in industry. It provides one of the best methods for providing opportunities for workers with differing abilities.

### Factors Affecting Efficiency

There are several factors in industry which, while they cannot be completely eliminated, should be reduced as much as possible. Some of the most common of these are accidents, fatigue, and fear. Each of these contributes to differences in efficiency between workers, and their combined effects are influential factors in the general effectiveness of any industry. Other factors affecting efficiency are the selection and promotion of workers, the measurement of work output, and the problem of salary and wages.

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[22] Taken from Scott, Clothier, and Mathewson, *Personnel Management,* New York, McGraw-Hill, 1931.

**Accidents.** It has been estimated that more than 100,000 people are killed by accidents in this country each year. In addition to the number killed, there are 3,000,000 accidents serious enough to cause a loss of time

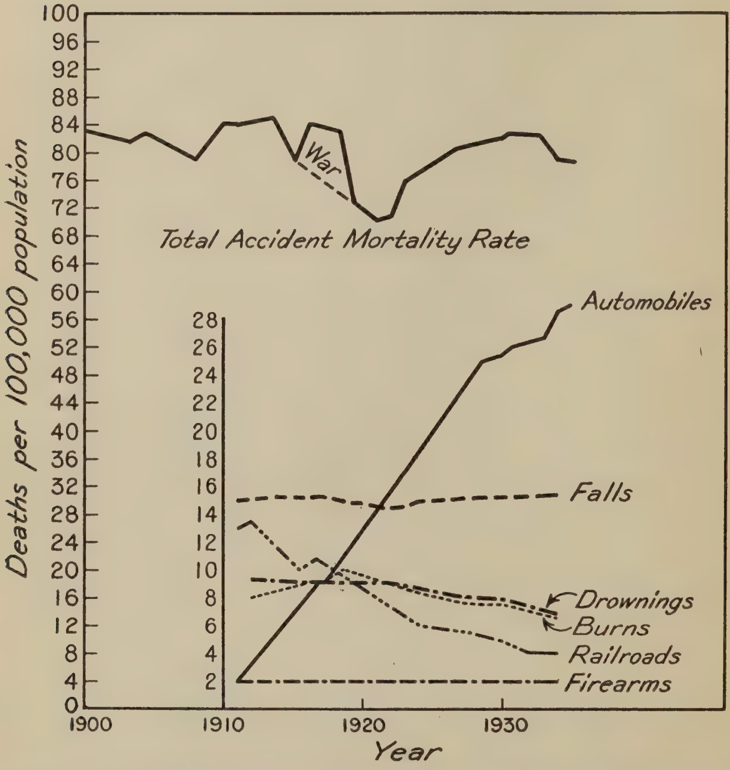

**Fig. 51.**—Graph Showing Accidental Deaths in the United States from Various Causes, from 1900 to 1934.

in work. It has been estimated[23] that this has resulted in annual wage loss of $1,300,000,000.

The knowledge of the tremendous cost of accidents in men and money has resulted in the formation of local and national safety organizations to study the causes of accidents and methods for their elimination. These and similar groups have promoted the passage of workmen's compensation laws in many states. This legislation has caused industry to become more interested in safety, since management is now financially responsible for accidents. The results of these movements are shown in the reduction of accidents in every major field of industry, except those caused by motor vehicles.

Reductions in accidents have come as a result of the study of two major questions, namely: (1) Who has accidents? and (2) What causes these accidents? The first question may be phrased in another way: Do accidents distribute themselves in a purely chance fashion without regard to persons or are some people prone to accidents, while others are relatively free from them? Several studies[24] have been made of this problem, with the same general results, showing that persons with few accidents in one period are likely to have few accidents in another, and that persons with many accidents in one period are likely to have many accidents in another. As Table LXV shows, Marbe's subjects who met with no accidents during the first five years of the study averaged about half (.52) an accident during a second five-year period. In

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[23] Viteles, *op. cit.*

[24] See Marbe, K., "Über Unfällversicherung und Psychotechnik," *Praktische Psychologie,* Vol. IV (1923), pp. 257–264; Newbold, E. M., "A Contribution to the Study of the Human Factor in the Causation of Accidents," *Industrial Fatigue Research Board Reports,* No. 34 (1926), p. 74; and Hildebrandt, H., "Zur Psychologie der Unfällgefahrdeten," *Psychologische Zeitschrift,* Vol. III (1928), pp. 1–8.

TABLE LXV

Comparative Results of Three Studies of Accident Causation

| *Investigator* | *Length of Period in Years* | *Number of Subjects* | *Number of Accidents per Period* | | |
|---|---|---|---|---|---|
| | | | *0* | *1* | *2 or more* |
| Marbe.......... | 5 | 3,000 | .52 | .91 | 1.34 |
| Newbold......... | 6 | 411 | .32 | .32 | 1.06 |
| Hildebrandt...... | 2 | 200 | .38 | .52 | 1.37 |

contrast, those who had two or more accidents during the first five-year period averaged one and a third (1.34) accidents during a second five-year period. The three studies included in the Table LXV show very similar results. In general, those who had two or more accidents during the first period averaged about three times as many accidents during a later period as did those who had no accidents during the first period. These results show conclusively that some people are much more prone to accidents than others. Industry is confronted with the problem of eliminating the accident-prone individuals from dangerous occupations. In keeping with this, some automobile insurance companies are giving preferential rates to accident-free drivers. There is some agitation for withholding drivers' licenses from persons with high accident records.

Is there any way by which we can predict the accident-prone individual before he has an accident? Snow[25] made a study of this problem for the Yellow Cab Company. By means of an ingenious but simple test, in which the subject was required to go through the motions of stopping a car model when something went wrong, he found that some prospective cab drivers took several seconds, while others took only a fraction of a second, to bring the car to a stop. Those taking a long time, he found, were much more prone to accidents than those taking a short time. Some even more significant studies of accident-proneness have been made with streetcar employees. The Philadelphia Rapid Transit Company submitted a list of names of 100 trainmen with exceptionally good records and another 100 with exceptionally poor records. From these, Viteles[26] selected fifty-four employees who had served less than fifteen years with good records and paired them with an equal number of employees with poor records. In the pairing, length of service was made the same for each group. Table LXVI gives the results of this study:

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[25] Snow, A. J., *Psychology in Business Relations*, New York, McGraw-Hill, 1925.

TABLE LXVI

Number of Accidents for 54 Good and 54 Poor Motormen

| *Type of Accident* | *Good Motormen* | *Poor Motormen* |
|---|---|---|
| Vehicular ............ | 7 | 136 |
| Automobile .......... | 34 | 511 |
| Personal ............. | 0 | 27 |
| Streetcar ............ | 16 | 110 |
| Total ............. | 57 | 784 |

From these results, it can be seen that the poor motormen had about fourteen times as many accidents as the good motormen, although both groups had the same amount of experience. Other studies have given similar results. Some men make good motormen, while others make poor motormen.

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[26] Viteles, *op. cit.*, pp. 373–375.

Another study[27] attempted to analyze the causes of accidents by test. Three batteries of tests were used. One was a series of muscular performances, such as tapping, reaction time, and motor skill; another, a series of "temperamental instability" tests; and the last, a test of intelligence. Six hundred and fifty-one factory workers were used in the experiment. They were divided into two groups, on the basis of their test records. A comparison of the number of accidents of the two groups showed that those making good scores had only about half (74:125) as many accidents as those making poor scores. A further analysis showed that some of the predisposing causes of proneness to accident are: (1) age and experience; (2) disease; (3) fatigue; (4) speed of work; and (5) temperature and illumination.

Such studies as these have helped in understanding the nature of accidents and their causes. Safety organizations have also been instrumental in making machinery safer by providing guards and shields for cutting tools, electric wires, gears, and belts. Other safety measures have consisted in campaigns for safety through posters and contests. Despite all measures, however, motor accidents have increased year by year. More than 40,000 people are killed annually in this country by automobiles. The number of injured is many times greater. These facts were made clear recently to the writer when he asked a class of 100 college students how many had ever been injured in an automobile accident seriously enough to require medical attention. Approximately one in seven indicated that he had been so injured. The increase in automobile accidents has been steadily increasing, despite the fact that automobiles are continually being made safer. But better brakes cannot compensate for the increased speed of driving. Something must be done to reduce the present rate of slaughter. Increased safety may come through more stringent traffic laws, restricting driving permits, better road conditions, and educating the public, including pedestrians, to the dangers of automobile traffic.

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[27] Farmer, E., and Chambers, E. G., "A Psychological Study of Individual Differences in Accident Rates," *Industrial Fatigue Research Board Reports,* No. 38 (1926), p. 46.

**Fatigue.** Another influence which reduces efficiency is fatigue. There is some reason to believe that a certain amount of fatigue is normal, but when fatigue becomes extreme, it is certain to cause a reduction in efficiency. This leads to the question of the definition of *fatigue*. Out of the many definitions, two[28] quite different ones emerge. One, an essentially behavioristic definition, emphasizes the reduction of efficiency; the other, an introspective definition, emphasizes the feelings of fatigue. That the two are not the same was proven by an experiment by Poffenberger,[29] in which he had subjects keep a report of their feelings during a task, while he kept a record of their work output. The feeling of fatigue was often high during good output and at other times, when the feeling of fatigue was absent, output was low. Although there are these two definitions of fatigue, this discussion will be concerned primarily with the definition emphasizing reduced output.[30]

Several studies have been made of the output of workers at different times during the day. The curves in Figure 52 are typical of cases where the task requires a considerable expenditure of muscular energy:

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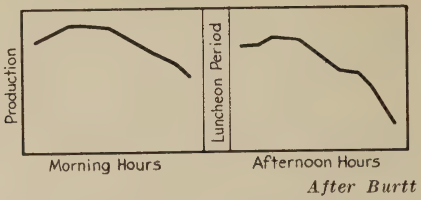
[28] A third definition is mentioned in Ford, A. A., *A Scientific Approach to Labor Problems,* New York, McGraw-Hill, 1931.

[29] Poffenberger, A. P., *Applied Psychology,* New York, Appleton-Century, 1929, p. 135.

[30] The reader who is interested in a more general discussion of fatigue is referred to Viteles, *op. cit.,* Chs. XXI and XXII.



*After Burtt*

**Fig, 52.**—Typical Daily Production Curves.

There is a relatively rapid rise in output during the first hour or two of work. Then there is a tapering off and finally a loss before the noon hour. This loss is generally assumed to be due to the loss of food energy and the storing up of poisons produced by muscular work. After the noon hour, the curve of work is similar to that of the forenoon, except that it does not rise as high; it begins to descend earlier and it falls to a lower level than at any other time during the day. Why there should be an increase for the first hour or more in the morning is somewhat of a puzzle; the fact is, however, generally recognized. Almost any athletic team takes a short practice period before the game starts. It may be that this initial practice stimulates circulation and causes the maximum flow of food products to the muscle tissues involved. Some recuperation occurs during the noon rest period, but it is incomplete. Therefore the afternoon output seldom reaches the height of the forenoon; its highest peak is shortened and the decrease starts early. Fatigue is more complete in the afternoon, and a night's rest is necessary for recuperation. It has been shown that the daily fluctuation is a function of work and not of the time of day. The peak of production comes at approximately the same distance from the start, whether work begins at 7:30 A.M. or 10:30 A.M.

A study of weekly output, as shown in Table LXVII,[31] indicates that there is also a weekly rhythm. Monday is the poorest day; Wednesday and Saturday are the best days. The Saturday increase is sometimes called an end spurt due to the anticipation of a vacation.

TABLE LXVII

PERCENTAGE OF DAILY WORK OUTPUT OF NINE MACHINISTS DURING A WEEK

| *Day of Week* | *Cutting Threads* | *Screw Slitting* |
|---|---|---|
| Monday | 94.7% | 96.3% |
| Tuesday | 96.5 | 97.9 |
| Wednesday | 100.0 | 100.6 |
| Thursday | 97.9 | 98.6 |
| Friday | 98.6 | 99.6 |
| Saturday | 104.5 | 102.7 |

The curve of fatigue is not necessarily the same where the task does not require heavy muscular work. Highly automatic processes requiring a small expenditure of muscular energy seem to show less variation during the day than heavy work. The curve for mental work varies with the individual and with the difficulty of the task. In her famous experiment of mentally multiplying four-place numbers by four-place numbers, Miss Arai,[32] at the end of twelve hours of continuous work, was approximately one third to one half as efficient as at the beginning of the day. Unless highly motivated, most of us would give up such a task, thinking ourselves completely exhausted.

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[31] Data taken from Richter, W., "Leistungssteigerungen in der Blankschraubenfabrikation durch Einführung von Zwangspausen," *Industrielle Psychologie,* Vol. VIII (1931), p. 135 ff.

[32] Arai, T., "Mental Fatigue," *Columbia University Contributions to Education,* No. 54 (1912).

The length of the working day also has a great influence upon the degree of fatigue produced. Several studies have been made on this problem. Lipman [33] analyzed 234 cases of work in diverse industries. He found that the optimum working day varied for different kinds of work. For the glass and porcelain industries, it was between 5.8 and 6.1, with a median of 5.9; in the tool-making industry, between 7.2 and 7.7, with a median of 7.4; and in the textile industries, between 10.5 and 13.6, with a median of 11.9. This investigation also found that age affected the best length of the working day. The optimal age for the longest day is between thirty and thirty-five; for the shortest, between twenty and twenty-five. The best workers can also work the longest day.

Several factors which complicate the problem of the length of the working day have already been mentioned. There is still another of as much importance, if not more, as any yet mentioned. Mosso,[34] in some of the first experimental studies of fatigue, found that the spacing of work or of the rest periods between work made a great difference in the rate of fatigue. He had the subjects raise a weight by flexing the finger. The finger was flexed in time with the beating of a metronome. When the rate of flexation was increased, the amount of work accomplished was reduced and the recovery time from exhaustion was increased. In the work of Taylor,[35] with the lifting of pig iron, it was shown that, by properly spaced rest periods, the daily output was increased from twelve and a half to forty-seven and a half tons. The best spacing of work and rest periods depends upon so many factors that to formulate specific laws governing it is impossible. In general, the heavier or more monotonous the work, the more often rest periods are needed. One study[36] has shown that rest pauses are often of value, not so much for relieving fatigue, as for improving the mental attitude of the workers.

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[33] Lipman, O., *Das Arbeitzeitproblem,* Berlin, 1924.

[34] Mosso, A., *Fatigue,* New York, Putnam, 1904.

[35] Taylor, *op. cit.*

The length of the working week was investigated in some other studies.[37] It was found that approximately a forty-hour week proved better than either a longer or shorter time. The studies were all made for jobs where the work was of a routine character and did not require an excessive amount of muscular energy.

The fact of great individual differences in fatigability is so apparent as hardly to need mentioning. The difference between the frail, sickly man and the heavyweight wrestler or prize fighter is so great that we do not think of comparing them. Yet the problem of selecting workmen for heavy manual labor is largely one of selecting strong men who do not fatigue easily. Likewise the outcome of many a hard-fought football game depends upon which team has the greater endurance or the most good substitutes. Poffenberger presents a graph (Figure 53) showing that persons with approximately equal initial strength may vary greatly in rate of fatigue.

After a careful analysis of work curves, one German investigator[38] came to the conclusion that there are three characteristic energy types: (1) the *energetic* type, which produces a high level of work for some time, often with some increase at first, followed by a gradual drop, but without complete exhaustion until after the accomplishment of a large amount of work; (2) the *an-energetic,* which begins at a high level, dropping steeply and maintaining a low level before exhaustion; and (3) the *fatigable* type, which shows a rapid and more or less regular drop, with quick fatigue. Such a classification is convenient only to point out that characteristic differences do occur. Obviously, people are not clearly separated into three distinct types.

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[36] Pennock, G. A., "Industrial Research at Hawthorne," *Personnel Journal,* Vol. VIII (1930), pp. 296–313.

[37] See Wyatt, S., "Variations in Efficiency in Cotton Weaving," *Industrial Fatigue Research Board Reports,* No. 23 (1923); Vernon, H. M., and Bedford, *Journal of the National Institute of Industrial Psychology,* Vol. II (1925), pp. 155–158; and Miles, G. H., and Angels, A., "The Influence of Short Time on Speed of Production," *Journal of the National Institute of Industrial Psychology,* Vol. II (1925), pp. 300–302.

[38] Lehmann, H., "Messung des Kraftimpulses," *Industrielle Psychologie,* Vol. V (1928), pp. 264–272.

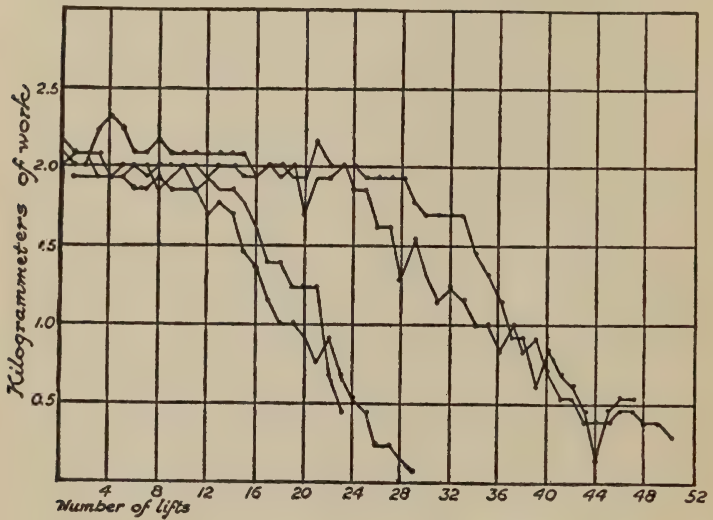

**Fig. 53.**—Individual Differences in the Rate of Fatigue. (Reproduced by permission of the publisher from Poffenberger, A. T., *Applied Psychology,* New York, Appleton-Century, 1929.)

Many writers have attempted to distinguish between mental and physical fatigue. But, as far as we can discover, most so-called "mental" fatigue is only a form of physical fatigue. It has been found that there is a very slight production of carbon dioxide in a nerve fiber as nervous currents pass over it. However, the loss of energy is very small. The principal energy changes occur in the muscles enervated by the nerve impulses; hence mental fatigue is generally, if not always, a form of physical fatigue. If there is such a thing as mental fatigue, it is in those relatively rare cases of nervous disease which affect the nerve tissues.

A point that should be made in closing the discussion of fatigue is that, in industry, a certain amount of fatigue is inevitable. The important problem is to reduce this amount to a minimum. Some of the methods by which this is accomplished are by securing a satisfactory arrangement of working hours, correct seating, and generally good working conditions. Finally, fatigue is dependent greatly on the attitude of the worker toward his work and toward the management.

**Fear.** Although difficult to locate and measure, fear is another serious handicap to the greatest efficiency of the worker. One authority[39] lists no less than thirteen different sources of fears to which the worker is susceptible. Fears of unemployment, discharge, injury, and wage reductions are only a few of the more obvious forms. No worker suffering from any of these causes of fear can do his best. While fear is often used as a method of motivating workers, it is one of the poorest forms of motivation known and often beset by dangers. It is rather by making the employee feel safe and secure in his work that he can and will do his best.

Certain occupations are peculiarly susceptible to the effects of fear. Many day laborers are hired by the day or week, with no thought of permanence. The professional worker is less subject to fears, but many a doctor or dentist worries about how to secure more patients and whether the ones he has can or will pay their bills. The owner of a business never knows when some competitor will cut into his business; at any time some new method of manufacture may make his product or method of production obsolete. The insurance salesman does not know whether or not his prospects will buy from him. Although the college professor has one of the safest jobs of all, yet he too may lose his job through no fault of his own. The college may lose its enrollment or endowment, or some new administrator may change the organization of the college. Although there is no situation in which fear may not take possession of a person, its paralyzing rather than activating influence makes it a poor instrument of motivation. Accidents, fatigue, and fear are all factors which in so far as possible, should be eliminated or at least reduced to a minimum in industry.

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[39] Scott, W. D., and Clothier, R. C., *op. cit.*, pp. 362–363.

At first thought, it might seem that, if there were an efficient analysis of the individual and an analysis of the job, there would be no problem of selection and promotion in industry. Even granting the best possible analyses of the individuals and the jobs, there would still be a problem of getting the right man in the right place, and that would be no small task. Especially with the admitted inaccuracy of both these analyses, the difficulties of selection are even greater than might be expected. Then again, in many industries there is little or no individual or job analysis. In such cases, the work of selection and promotion is simply prodigious. Only the most clever employment manager can improve much over pure chance.

This is well illustrated by the results obtained by Hollingworth.[40] He asked twelve professional interviewers to interview fifty-seven applicants for the position of salesman. The interviewers were to use any method they chose. All that was required of them was to rank the applicants from 1, for the applicant they considered best, down to rank 57, for the one they considered poorest. Table LXVIII gives some of the results secured, which are typical:

TABLE LXVIII

RANKS ASSIGNED APPLICANTS BY INTERVIEWERS

| *Applicant* | *Interviewer* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* |
| A. . . . . . . . . . . . . | 33 | 46 | 6 | 56 | 26 | 32 | 12 | 38 | 23 | 22 | 22 | 9 |
| C. . . . . . . . . . . . . | 53 | 10 | 6 | 21 | 16 | 9 | 20 | 2 | 57 | 28 | 1 | 26 |
| E. . . . . . . . . . . . . | 54 | 41 | 33 | 19 | 28 | 48 | 8 | 10 | 56 | 8 | 19 | 26 |
| G. . . . . . . . . . . . . | 33 | 2 | 13 | 16 | 28 | 46 | 19 | 32 | 55 | 4 | 16 | 9 |
| I. . . . . . . . . . . . . | 2 | 36 | 6 | 23 | 11 | 7 | 23 | 17 | 6 | 5 | 6 | 9 |

This study shows that the rankings of the same individual by different interviewers are not at all consistent. For example, Applicant C was ranked the best of the whole group by Interviewer 11 and poorest of the group by Interviewer 9. Many of the other applicants received rankings from one extreme to the other. If there had been a limited number of jobs to fill, it would have made a great difference which interviewer had the right of selection. This should be encouraging to the person looking for a job. If one employment manager turns him down, he may hope that the next one will be favorably impressed. One fact can be ascertained from this study, namely, that some applicants—like Applicant I—tend to receive good rankings, while others—like Applicant E—do not receive such high rankings. This, of course, does not prove that Applicant I would make a better employee than Applicant E; it means only that most of the interviewers *thought* he would.

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[40] Hollingworth, H. L., *Judging Human Character*, New York, Appleton-Century, 1923, p. 65.

Scott[41] conducted a similar experiment, in which thirty-six applicants were rated by six sales managers. He also had thirteen executives rate twelve prospective salesmen. Later he checked the actual sales performance of these men with their ratings. The interview was shown to be less than twenty-five per cent better than chance in predicting sales success.

Only by the most careful and accurate methods can anything like an adequate job of selection be made. Too often promotion depends upon making a good impression on the foreman or some officer, rather than upon efficient work. Nothing can kill the morale of an organization quicker than inadequate promotion methods. Promotion must come as a well-prepared, logical sequence of steps from one job to another. Only by such methods can the individual characteristics of each worker be adequately provided for.

**Measurement of work output.** In piecework, it is relatively easy to measure output; nevertheless, there are complications and factors that make a true measure of efficiency difficult, even in such simple circumstances. If quality as well as quantity are to be considered, how can the two be equated? If one typist can do six pages with not more than five errors per hour and another but four pages with less than one error per hour, which is the better typist? The kind of work also makes a difference in rate of speed and output. Copying tables, for example, is more difficult than ordinary letter writing. Where comparisons are being made, the kind of material to be typed and the kind of machine used, as well as the working conditions, must be considered in measuring any kind of efficiency.

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[41] Scott, W. D., "Selection of Employees by Means of Quantitative Determinations," *Annals of the American Academy of Political and Social Science,* Vol. LXV (1916), pp. 182–193.

The problem is further complicated by the fact that many industries are not organized on the piecework plan. For example, automobile assembling in the typical plant and all kinds of personal service, from that of mechanic's helper to secretary and personnel officer, cannot be rated on a piecework basis. These are only the beginning of the difficulties involved in estimating the relative efficiency of workers. How, for example, can the relative worth of a production manager and a sales manager in the same factory be compared? Executive and professional ability are even harder to evaluate, and a comparison of the same positions in different industries presents still further difficulties.

Difficult as the problem of determining the relative worth of different abilities is, industry is continually faced with the need to make some kind of evaluation. Methods of all sorts are used, or none at all. Often there is an attempt to evaluate on the basis of the preparation necessary for the work. Thus it may seem ridiculous, from one point of view, to pay a surgeon at the rate of $50 or $100, or even more, for a few minutes' work; but one must consider how long it took the surgeon to learn how to remove an appendix, for example. Another case in point is that of Chief Justice Charles Evans Hughes, who, while still a practicing attorney, is reported to have received a fee of $30,000 for an opinion on the Chicago water diversion case, which required only a few hours of his time to prepare but which few others would have been able to render with almost any amount of preparation. Another method for the evaluation of services is on the basis of the orthodox economic principle of supply and demand. Salaries are regarded as economic goods and command the same treatment as goods. This principle has wide applicability and certain advantages over others, especially in these times of an attempted reduction of everything to a common denominator of dollars and cents. But it also has certain inherent limitations. In other words, there is a growing skepticism of the universality of the law of supply and demand, even among the economists.

**Salary and wages.** The discussion of efficiency almost inevitably leads to the problem of salary and wages. While salary and wages are not the only rewards of labor, they loom largest on the list. In 1929, Moulton and others[42] made the first comprehensive survey of family incomes in the United States. The data presented by this study indicate that the average family of four in this country received an annual wage of about $1,600, while families in the lowest quarter received $1,100 or less. Normally, there are from 4,000,000 to 6,000,000 people in this country without income. In 1929, only two per cent of the population received $10,000 or more per year, while 513 people received an annual income of $1,000,000 or more.

A more recent study of family incomes in the United

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[42] Leven, Maurice, Moulton, H. G., and Warburton, Clark, *America's Capacity to Consume,* Washington, D. C., The Brookings Institution, 1929. Also Moulton, H. G., *Income and Economic Progress,* Washington, D. C., The Brookings Institution, 1935.

States has been made by the National Resources Committee[43] in a survey of 300,000 representative families. This report gives a lower family income than the Moulton report. Whether this difference is due to a different method of study or whether wages were lower in 1935–1936 than about ten years earlier, we do not know. Figure 54 shows the distribution of family incomes as given in the later study:

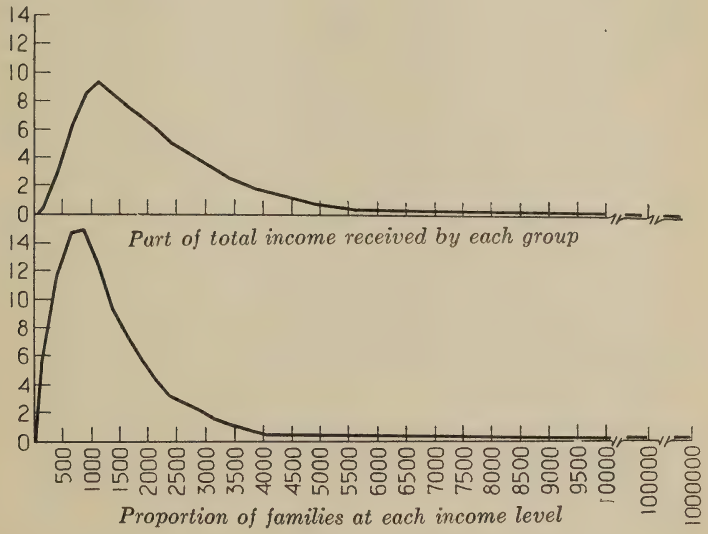

**Fig. 54.**—Distribution of Family Incomes.

Fourteen per cent of all families received less than $500 per year, forty-two per cent less than $1,000, sixty-five per cent less than $1,500, and eighty-seven per cent less than $2,500. Above the $2,500 level, there were about ten per cent with annual incomes up to $5,000, about three per cent with incomes over $5,000, and only one per cent with incomes of $10,000 or more. The fourteen per cent of all families receiving $500 or less actually received less than two and three fourths per cent of the total annual national income, whereas the three per cent of the population with incomes of $5,000 or over received twenty-one per cent of the total national income and the incomes of the top one per cent accounted for a little over thirteen per cent of the aggregate. Table LXIX gives the results of this study in tabular form:

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[43] National Resources Committee, *Consumer Incomes in the United States—Their Distribution in 1935–1936,* Washington, D. C., Government Printing Office, 1938.

TABLE LXIX

DISTRIBUTION OF FAMILY INCOMES AND PERCENTAGE OF THE TOTAL NATIONAL INCOME RECEIVED BY EACH GROUP FOR 1935–1936

| *Family Income Group* | *Percentage of Total Population* | *Percentage of Total National Income* |
|---|---|---|
| $ 0–250 | 3.95 | .28 |
| 250–500 | 10.26 | 2.45 |
| 500–1,000 | 27.47 | 12.84 |
| 1,000–2,500 | 45.75 | 43.99 |
| 2,500–5,000 | 9.86 | 19.60 |
| 5,000–10,000 | 1.74 | 7.36 |
| 10,000–25,000 | .77 | 6.87 |
| 25,000–100,000 | .19 | 4.74 |
| 100,000–500,000 | .01 | 1.34 |
| 500,000–1,000,000 | .00* | .23 |
| 1,000,000 and over | .00* | .30 |

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* Less than .005 per cent.

These data show how widely distributed incomes are and how they are piled up at the lower end of the distribution, with a very long but narrow spread at the upper end. It is interesting to consider this fact in comparison with the distribution of such traits as, for example, general intelligence. Should any or all forms of income show a form of distribution similar to the curve for abilities, such as general intelligence? It may well be argued that higher grades of abilities should be rewarded with more than a corresponding wage. Babe Ruth is reported to have received $80,000 a year from the New York Yankees as long as he could hit from fifty to sixty home runs per season and maintain his position as right fielder. As soon as he slowed down and could hit no more home runs than other players, he was given his release. Similarly, the services of the president of a large organization like the Bethlehem Steel Company may be held to be worth as much as the services of from 500 to 1,000 ordinary laborers (the salaries are the same).

No doubt high executive and administrative abilities are to be justified, not on the basis of any single trait like intelligence, but rather on the basis of a constellation of several traits. It is in those relatively rare individuals in whom is combined a group of favorable traits that we find our great leaders.[44] No doubt the grouping is different for different kinds of leadership. It goes without saying that, at least occasionally, there are those who by chance or fraud[45] have secured positions of undeserved responsibility. This fact, however, does not answer the question of what kind of distribution of income can be justified on the basis of real worth. Only the extreme Communist could justify a uniform wage scale for all, for any recognition at all of individual differences would justify a range of wages. How wide this range should be and what form of distribution it should take, however, is a problem replete with economic, social, political, and religious implications. Any adequate treatment of this subject would constitute the material for another book.

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[44] For a discussion of the form of the distribution of incomes, see Pareto, V., *Cours d'économie politique,* Livre III, Lausanne, Rouge, 1897, Ch. I; and Davis, Harold T., "The Significance of the Curve of Income," *Report of the Fourth Annual Research Conference on Economics and Statistics,* Cowles Commission (July 1938), pp. 19–22. For discussions of the possibility that combinations of human abilities may distribute themselves under curves similar to the curve of incomes, see Boissevain, Charles H., *Distribution of Abilities Depending Upon Two or More Factors,* to be published in 1939. See also writings of H. T. Davis and Carl Snyder, especially a report of their symposium on the social implications of the Pareto distribution before Section K of the December 1938 meeting, at Richmond, Virginia, of the American Association for the Advancement of Science.

[45] For an interesting account of such practices, see Josephson, Matthew, *The Robber Barons,* New York, Harcourt, Brace, 1934; or Allen, F. L., *Lords of Creation,* New York, Harpers, 1935.

### Exercises

1. Justify or criticize the statement that individual differences are more important in business and industry than in most other fields.

2. Are there more or less differences among the abilities of the day laborers than among executives? What is the explanation for your answer?

3. Into what elements can a man's fitness for a job be analyzed? Can any generalization be made about the relative importance of these elements?

4. In which one of these elements can differences be most accurately measured? Why is this true?

5. What use could a vocational counselor make of Table LXI in interpreting differences in intelligence? What cautions should the counselor exercise in interpreting such a table?

6. What are some of the difficulties involved in measuring aptitudes?

7. Are the differences among people in any one aptitude greater or less than the differences among aptitudes in any one individual? Give possible reasons for your answer.

8. Compare individual differences with age differences among boys on the Minnesota Mechanical Assembly Test. What difference exists between the average eleven- and eighteen-year-old boy as compared with the difference between high and low eleven-year-old boys?

9. What evidence is there, if any, to indicate whether accidents are generally due to the lack of training, to poor training, or to inherent human defects?

10. Compare the recognition of individual differences in a society such as ours with the recognition of individual differences in a communistic society.

11. What facts from the study of individual differences might be particularly helpful in formulating laws for the reduction of automobile accidents?

12. Recognizing that the range of general ability is probably less than the range of monetary rewards for its use, what effect, if any, on this difference is to be expected by the inauguration of social security measures?

13. Name some common influences which reduce human efficiency that might conceivably be eliminated, and distinguish these from others that might be reduced but could not be eliminated.

14. What type of relationship probably exists between interest and success in business? Is such a relationship far removed from zero?

15. Name any differences between people that would be significant in determining their selection or rejection for a job but would not influence their promotion if they were hired.

16. When might test scores be better guides in vocational selection than either the results from a questionnaire or personal opinions? When should we rely on personal opinion in selection?

17. What type of distribution would you expect to get by (*a*) measuring the general ability of a large sample of the population; and (*b*) tabulating the incomes of a large random sample of the population of wage earners?

18. Why is the law of supply and demand not always the best method of determining salaries and wages? What are the chief factors which this law neglects?

19. Contrast the curve of mental test scores with that for incomes. What justification, if any, can you give for these differences?

20. In graphing family incomes, the curve is usually drawn over a base line extending from zero to the highest income received by any family. At other times it is drawn from a point below zero, perhaps at —300. What justification can be given for the two values used as the lower limit? Can a family earn less than nothing? What is the lower value if both family income and cost of maintainence are considered?

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## CHAPTER XIII

# The Significance of Individual Differences

### How Individuals Differ

In the preceding chapters the important facts concerning human differences have been reviewed. In this final chapter we shall be concerned, not so much with the kinds and extent of differences, as with the *significance* of these differences. Too often, even if we know the facts in some field of knowledge, we fail to see their importance. It will be the purpose of this chapter to point out some of these differences between people in relation to their social significance.

Socrates is ordinarily given credit for the injunction, "Know thyself." This spirit of investigation has dominated much of the thinking of mankind. Especially in our more reflective moments, we are all interested and concerned with our own points of weakness and strength. Despite this interest in himself, man knows much more about the world round about him than he does about himself. His world of ideas, feelings, and motives remain hidden and hard to discover. This same fact can be stated in another way by saying that the physical sciences have progressed much further than the social sciences. To explain this fact by saying that the physical sciences have a less difficult task than the social sciences states a truth, but it does not greatly help us in our present discussion.

The older introspective psychology attempted a direct analytical attack upon man's mental make-up. Such an attack was only a natural outgrowth of the pervailing philosophy of the times. The philosophers were already using the introspective method in a broad way in an attempt to discover the nature of God and of the universe. In keeping with this movement, the introspective psychologist used the method under even more rigidly controlled conditions to study himself. It is not within the province of this chapter to review the contributions of the introspectionists, but it must be admitted that they made some significant contributions to the knowledge of the self. This statement is true despite the fact that Wundt and most of his followers were primarily interested, not in human differences, but only in typical human thought processes.

More recently, the objective school of psychology has attacked in a more quantitative fashion the measurement of typical human behavior, as well as differences between the reactions of people. As a result of these studies, we know many things about human capacities and differences. Extensive as our knowledge about differences is, there remains the great difficulty of applying this knowledge to problems of everyday life. We know much about how people differ in sensory capacities, intellectual capacities, special abilities, personality differences, and differences in human interests. As pointed out in Chapter XII, much is known about the requirements for many kinds of work. Vocational guidance attempts to tell a person what his abilities are and how to prepare himself for a job. While much has been accomplished in this endeavor, a great deal still remains to be done. Every boy and girl and every unplaced adult is faced with the very practical problem of deciding upon, preparing for, and securing some type of suitable work.

We must classify ourselves; we must place ourselves in relation to the other people with whom we associate. This evaluation cannot be made in one field only or by one general ranking of ourselves, but by a ranking in many fields and in the various social groups to which we belong. For example, we must consider our vocational fitness for the rôle of garage mechanic, farmer, soldier, banker, factory worker, insurance man, student, or a professor. Most of us also belong to some union, lodge, church, political party, or other social organization, either as officers in one or more of these or only as members. We are also associated with other people in many informal ways, as neighbors, friends, or associates. As William James once said, "A man has as many social selves as there are individuals who recognize him." Each person, therefore, must evaluate himself. It will be to his advantage to accumulate as many facts of all kinds about himself as he can. Experts may be of service in securing and interpreting this information, but, as a rule, each of us must be the final judge of what he can and should do. The sooner and the surer we can make this decision, the better.

This personal classification that each of us is to make of himself, which is partly voluntary and partly forced upon us in our social and economic struggles, is not entirely one of placing ourselves on some linear scale. Although some attempt is made through wages or salaries to evaluate ourselves and our services on one common scale, we all know that there are many other bases of human values. Not only are there many bases of values, but there are also varieties of interests and occupations, which can only be described as "different." Who can answer whether the painter, the composer, the teacher, or the social worker does society the greatest good? It is equally difficult to determine whether the bank robber, the crooked politician, or the man who knowingly sells bad securities does society the greatest harm. All that we can safely say in some of these cases is that men differ. Some of these differences are quantitative; others, at our present state of knowledge, can only be described as qualitative.

## Differences Between Social Groups

Approached from the point of view of the group, the differences we have been describing form the basis for social organization and grouping. Society is what it is because people differ. If everyone were alike, society would be radically different from what it is. In fact, there is a serious question as to whether there would be any society as such if everybody were alike. Although certain Eskimo tribes try to preserve greater equality between members of their group than is customary in our society, yet differences still exist among them. The Brook Farm experiment, in Massachusetts, was an attempt, as is that of the Oneida Community, at Oneida, New York, to place men and women on a basis of parity. But even these efforts have been unsuccessful from the point of view of producing human equality. Even heaven is not ordinarily assumed to be a place where all are alike and equal. Men differ, and these differences force themselves into the structure of society.

Social psychology might well be approached from the point of view of human differences. A recent text has partially attempted this task, in the sense that it discusses at the start uniform ways of behaving—such as folkways and mores—as contrasted with atypical ways—such as criminality, conflict, and competition. Yet, in mores we have but partial uniformity, and this only in a small segment of human behavior. For example, some tribes may honor their dead by fasting or have extended ceremonials initiating the young into the mysteries of the tribe. But in other respects there are differences. Thus the members of the tribe work at different tasks; there is a division of labor. The tribe has a king, a tribal council, a group of warriors, and often slaves. Modern society is so complex only because people differ so much in abilities and interests. If you think of all the organizations and social groups, both formal and informal, in your community, you will begin to appreciate the significance of this fact. The home, the school, the parent-teacher association, the church, the Y. M. C. A., the golf club, the bridge group—these all represent different interests and purposes. Within each group there are other subgroupings; there are committees and subcommittees. The university itself is a social grouping for certain rather specific purposes. A recent publication of one university campus with 4,500 students representing six different colleges listed 212 different organizations with membership ranging from but a few students up to some with 1,000 or more members. Some of these represent very high scholarship groups, such as Phi Beta Kappa and Sigma Xi; others represent the social fraternities and sororities. There are also the varsity-letter men, and one group of Negro students who call themselves the Quibblers.

It is not our purpose at this point to try to analyze the various social forces and groupings in society; we only wish to show that people do differ and that social stratification and social groupings are a way of expressing these differences. When people come to realize this fact more fully and to organize social groups on the basis of ability and interests, we will begin to have a better society. This does not mean that all who belong to a certain social group should possess the same ability, but it does mean that men possessing the greatest ability should be placed in positions of responsibility. Too often men with wealth and without ability, men with "pull," men who promise much and give little, men who gain positions of responsibility only because they have a pleasing appearance get into control. This is one great reason why there is so much social unrest. When men with both efficiency and ability are placed in charge of industry, are elected to office, and are given control in social organization, then there will be a better day. That time has not yet arrived partly because we do not always know how to select such people; we are blinded by propaganda, and too many are caught by or benefit from the present scheme of things.

## Individual Differences and Government

Human differences are significant in the organization of government. Various forms of government hold or at least imply different ideas about individual differences. Some forms of government are founded upon the theory that all people are inherently alike, while others assume that differences exist. The ways and the extent to which these differences are made use of varies from one form of government to another.

**Pure democracies.** In a pure democracy there is little recognition of differences. All persons are assumed to be equal. Laws are made and enforced by the people assembled in common council. In most cases where democracy in its pure form has been tried, it has been applied only to a small and highly intelligent section of society. In Greece, for example, slaves and barbarians (non-Greeks) were excluded from participation in the government. In theory, a democracy neglects the facts of human differences; in practice, because of this fact, it may avoid some of the evils of other more common forms of government which grow out of unfair competition, usurpation of power, and inherited privilege.

**Communism.** In theory, most forms of communism assume that all people are politically equal. This equality extends, not only to equality of opportunity and responsibility before the law, but to economic rights as well. While there are rulers to enforce the laws, and, in a sense, the selection of rulers implies a special class set apart, in a true communistic state these apparent differences are minimized as far as possible.

In the early days of communism in Russia, where this form of government was tried for the first time on a large scale, many difficulties arose. The establishment of communism was accomplished only by the use of force. The state took control of the large estates of the landowners and combined the small farms into collective enterprises. Natural resources became the property of the state; industries and distribution were also nationalized. In some cases the peasants continued to own their own homes, but in the urban centers the government controlled much of the housing. Even in those cases where the government did not take over the industry, there was close supervision of private enterprise.

In more recent times there has been some reduction in governmental control. Some forms of capitalism are now permitted, and foreign investments are sought in certain industries. Workers are now given a wage which varies for different kinds of work. The average urban wage is about 250 rubles per month, but authors, engineers, and other professional workers receive from 1,000 to 3,000 rubles. This is in accord with the accepted communistic principle "to each according to his needs." Needs and abilities at least roughly parallel each other. It is apparent, therefore, that communism does not ignore the fact of individual differences; it criticizes capitalism as based upon privilege rather than upon ability. Whether communism recognizes differences to be as great as they really are or whether, as pointed out in the preceding chapter, individual incomes in the United States are more widely distributed than human abilities is a subject upon which opinion will differ.

The respective merits of state and private ownership of natural resources is not a question of individual differences, except in so far as it may affect the distribution of wealth. As long as private incomes exist, they do not need to be so extensive as they now are for a fair recognition of differences. In the event that private incomes are less than they now are, smaller differences take on greater significance.

**Socialism.** This is a word with many different meanings. It is sometimes used as a synonym for communism; again, in Germany fascism is called state socialism. As used in this country, socialism generally refers to state ownership of natural resources and governmental control of industry. That is, socialism generally assumes the more common forms of republican government, with the customary election of political officials, who have their respective duties and responsibilities. This is a recognition of human differences. There is also a recognition of social differences, but the socialists maintain that these differences should not be based upon wealth. Most socialists in this country do not advocate a classless society. They do, however, condemn the capitalistic systems of the democracies and the totalitarian states, and demand that the state own and control all important resources and industries. According to them, wealth should be controlled by the group rather than by the individual, and this would minimize economic differences. Such methods would not eliminate all economic differences, and probably most socialists would not advocate complete economic equality with the same wages for all. Socialism accepts the principles of human differences, but criticizes the present practices in capitalistic countries because they have produced too large differences in wealth.

Socialism as described above has not been tried as a form of national government. Sweden, with its cooperative societies and state control of certain industries, probably most nearly approaches socialism. In Germany, before the advent of the Third Reich under Hitler, socialism was very strong as a movement among the laboring classes. But as advocated by most labor organizations in Europe, socialism aims more at securing a living wage for all workers and bettering working conditions than it does at setting up a special form of government. In so far as there is a tendency for cities to establish municipal ownership of certain industries, this may be called a move in the direction of socialism. But municipal ownership of street railways and electric power is not socialism as it is ordinarily defined.

**Monarchies.** A monarchy is founded upon the principle of inherent differences. Differences are recognized in all realms—political, social, and economic. The rulers inherit their positions or they are chosen from a royal group. The ruling classes generally dominate the social groups, although there are social distinctions down to the lowest servant class. During the Middle Ages, there was often a political organization in each country with the king at its head and another group, based largely upon land ownership and wealth, of which the barons were at the head. In some cases, at least, these barons exercised more power and control than did the king. Monarchial government, therefore, recognizes differences, but it differs from democratic government in that it places the emphasis almost wholly upon the hereditary basis.

In recent times the theory of absolute hereditary monarchy has almost disappeared. The nearest approach to this form of government in the political state is found in Japan. The Japanese emperor, who is considered sacred, inherits his position from a line which extends further back than 700 B.C. The emperor has absolute authority in making war and peace, and in appointing his ministers. The army and navy are directly responsible to him. For civil affairs, there is a Diet which enacts laws, but in an emergency the emperor may issue ordinances that have the force of law. In most other modern monarchies the power of the king or emperor is very limited. In limited monarchies, like that in England, the political power of royalty has been curtailed almost completely, so that about the only thing left for royalty is its social prestige. Politically, England is generally classed as a republic.

**Republics.** In republican governments—or democracies, as they are usually called—like our own, differences are recognized. Despite the fact that the Declaration of Independence says that "all men are created equal," it is generally recognized that this equality applies primarily to equality and responsibility before the law. Even in these realms, equality is an ideal that is not attained in actual practice. It is also true that, except for certain limitations—such as age—in a democracy all persons have the same rights and opportunities to vote. Every vote counts equally in registering approval or disapproval of any principle, law, or candidate for office. In electing men to office, political differences are created. There is a hierarchy of political offices from the president down. Industry and ability may be rewarded by the highest office in the land. Again, it need only be mentioned that this is the ideal, which is never attained in practice.

Republican government has almost always been associated with capitalism. In economics, as in politics, differences are fully recognized. While the old *laissez-faire* doctrine, giving unlimited opportunity either for success or failure, may be supplanted by controlled economy and social legislation, yet capitalism is a part of democracies as they are now constituted. Whether the two ideas could be segregated remains to be discovered. Democratic government is one in which, while equality before the law exists, yet differences are also recognized. The social and economic structure in a democracy is primarily based upon differences, while equality is recognized in responsibility and voting rights.

**Fascism.** Fascistic, or totalitarian, governments also recognize differences. Here there is an implied recognition that some have the right to dominate and control the policies of the state. Authority of the ruling class extends to all fields, including a dominant control over the wealth of the state. This sometimes takes the form of actual ownership of industry and natural resources, though more often it consists in close supervision and control of industry and resources.

In fascist states there is a distinct stratification of society. One large element in this social differentiation is based upon the acceptance of the political beliefs of the ruling party. If actual conformity is not forthcoming, at least passive conformity to the state is compelled by force. The chief characteristic of totalitarian states is that the ruling class is generally a minority who has seized power and forces its ideas upon the people. Like monarchies and other kinds of government, the true worth of this form of government is to be measured in terms of its fairness and efficiency in dealing with its own people as well as with other nations.

**Summary.** In summary, we may say that there are many ways of evaluating different forms of government. There is no attempt here to do more than consider the different forms in the light in which they conceive, accept, and apply the facts of individual differences. From this point of view, a *pure democracy* largely neglects human differences. This form of government would therefore not be successful, except in a society where all people were equal or nearly equal. It would also not be well adapted, except where the level of intelligence was high. *Communism* in theory does not deny that differences exist, but it minimizes them. Most people outside the communistic party believe that communism reduces everybody too nearly to the same level, that it does not fully recognize the extent of human differences. *Socialism,* in its most commonly accepted definition, recognizes greater differences and makes greater provision for differences than communism. Governmental ownership of industry might reduce economic differences by eliminating the possibility of large fortunes made through the control of natural resources or some important commodity, but it would not eliminate differences. *Monarchies* recognize differences, but generally assume that these are due to inherited qualities. Although experimental evidence shows that many differences are inherited, still others are acquired through training. Any form of government that does not take into account both inherited and acquired differences has failed in this important respect. *Fascism* rests upon the acceptance of differences. In practice, it creates a class who are assumed to be so superior that they are different in kind from other people. It sets up a class of supermen to rule over others. The differences which the fascistic state recognizes are largely based upon coercion and force rather than ability and justice. *Republics* accept the fact that people differ. Sometimes there has possibly been a tendency to believe that differences are greater than they really are. Republican governments are also committed to the doctrine that every man has certain inalienable rights—moral rights to life, freedom, and a voice in determining who will make his laws and rule over him.

### Exercises

1. What are some of the changes that would occur in industry if we had more information concerning human abilities and interests, and if we made a wiser use of this information?

2. How would such changes affect: (*a*) the individual in his vocational preparation and adjustment; and (*b*) the economic conditions of the country?

3. Name some changes which would occur in the life of the community if the abilities and interests of people: (*a*) were more nearly alike; and (*b*) differed more.

4. In what way may many of the small social groups on a campus be considered as evidence of individual differences among students?

5. Does the recent evidence about the dependence of intelligence and ability upon environment and social conditions indicate anything about the possible dangers of justifying social organization and government on the basis of the extreme differences that are found in some countries?

6. Does a monarchy recognize individual differences in any way not recognized in a democracy? Compare communistic governments and totalitarian states, both in theory and practice, in their recognition of differences.

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